CAVING·RIGGING·PIONEERING·HANDICRAFTS·FIRST AID

SAILING·RESCUE·TRADES·BUSHCRAFT·NETTING·IMPROVISATION·CLIMBING·MARINE

FISHING·DOMESTIC·MOUNTAINEERING·BOATING·FANCY WORK·TACKLES·TRANSPORT

SPLICING·CAMPING·CONSTRUCTION·SENNITS·FARMING

A FRESH APPROACH TO KNOTTING AND ROPEWORK

You can tie more knots than you think. There is a logic in the construction and modification of knots. This book, arranged according to the structure of the knot, illustrates some of this logic. As you work your way through it, you will find that you can readily build on your present knowledge and skill and tie a whole lot of knots you had not come across before.

There are some 1500 diagrams in this book, illustrating the tying and use of some 500 knots, selected from those found in a wide variety of applications, from climbing to construction, farming to fishing, sailing to scouting, rescue to rigging, first aid to fancy work, transport to tying up parcels, crafts to camping, household improvisations to hitching up animals.

The book is not just a collection of empirical recipes on how to tie particular knots, but provides fresh ideas about knots, their construction, their function, how to tie them, how to apply them and how to tailor them to your needs. It allows a quick and easy expansion of the stock of knots you know, to just about all kinds of knots, tied in just about any kind of rope, cord or line. Anyone using rope or lines to any significant extent, even if limited to a particular craft, trade or hobby, will find here much practical advice and some excellent tips about how knots can fit in with the user's requirements or how they can be modified or adapted to fit in even better.

A special feature is the attention given to the rope and knots used by modern climbers, cavers, mountaineers and rescue workers, topics not usually covered in general knotting books.

The author, **Charles Warner**, has been learning about knots for more than 60 years, teaching others how to tie them for more than 50 years, and applying them for at least as long in a wide variety of outdoor sports, handicrafts and domestic contrivances.

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A FRESH APPROACH TO KNOTTING AND ROPEWORK

Charles Warner

A FRESH APPROACH TO

KNOTTING AND ROPEWORK

Dedicated to the memory of

LIONEL REES

One time Army Instructor in Field Engineering

Foundation Instructor in Pioneering
Baden Powell Scout Training Camp, Pennant Hills

who first showed me that knots and ropework
were not just sticks and string, toys and puzzles

A FRESH APPROACH TO

KNOTTING AND ROPEWORK

Knots arranged
According to their Structure

Charles Warner

Written, Illustrated, Typeset and Published by
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International Guild of Knot Tyers 272

did I turn to knotting books for anything more than the solution of an immediate problem. The books and writings I have found most useful in preparing this book were:
Harry Asher's *The Alternative Knot Book* (Nautical Books, 1989); and several contributions for publications of the International Guild of Knot Tyers;
Clifford Ashley's *The Ashley Book of Knots* (Doubleday Doran, 1944);
Percy Blandford's *Practical Knots and Ropework* (Tab Books, 1980);
Geoffrey Budworth's *The Knot Book* (Elliot Right Way Books, 1983);
Sam Svensson's *Handbook of Seaman's Ropework* (Granada, 1971);
Alan Vare's *The Hardy Book of Fisherman's Knots* (Camden, 1987).
There have also been quite a number of other books from which I learnt a knot or two, or gathered some hint on the tying or application of some knot. The newsletter of the International Guild of Knot Tyers, *Knotting Matters*, has also been a fruitful source of ideas. All these sources allowed me to extend the list of knots exhibiting particular structures.

Judith Bateman, Roy Belshaw, Frank Brown, Megan Bowden, Len Fairclough, Andrew Homann, Tim Lamble, Bill Langlois and Maurie Sexton have all read drafts of this book, and made most valuable comments and suggestions on how to improve it. I am very pleased to be able to recognise their help. In particular, Judith Bateman clarified my mind on many of the properties and applications of kernmantle rope.

Any mistakes that remain after all this help are my own.

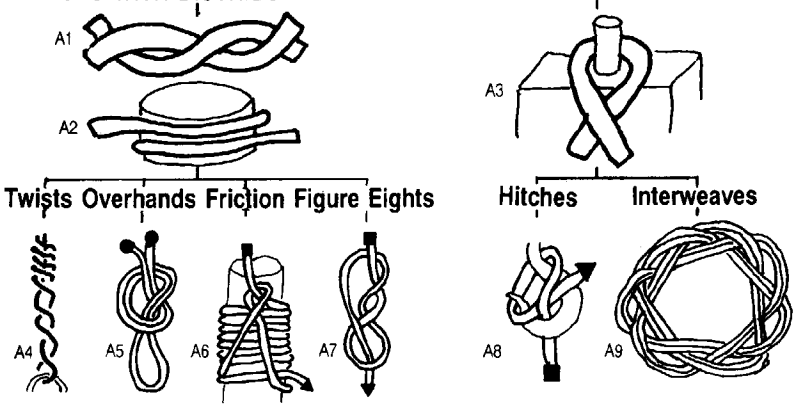
THE PLAN OF THIS BOOK

PART 1 Background information to help you get going:

ROPE — Manufacture, Preparation and Care
KNOTS — Tying, Testing and Classifying

PART 2
PART 3 These Parts constitute the core of the book and demonstrate the method of arranging the knots by their structure, the way they get their grip. About 500 knots are thus classified, with notes on how to tie them and what they are used for. This system of arrangement is illustrated below; more details in the next few pages.

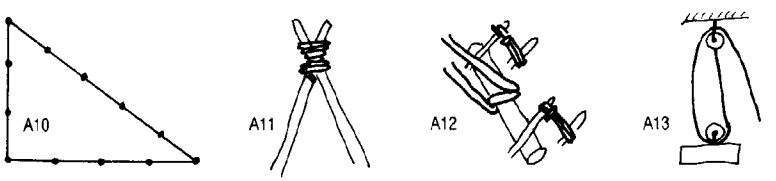
KNOTS WITH DISTRIBUTED NIP — Twists, Overhands, Friction, Figure Eights
KNOTS WITH CONCENTRATED NIP — Hitches, Interweaves



PART 4 Designer knots: the search for different knots, how to design, tie and test novel knots, for fun, for study, for one-upmanship, for decoration or for serious use.

PART 5 Field Engineering, basic techniques using rope for planning and implementing large projects. Many of these methods were used in the building of the pyramids, but still find plenty of uses.

Surveying — Lashings — Anchorages — Tackles



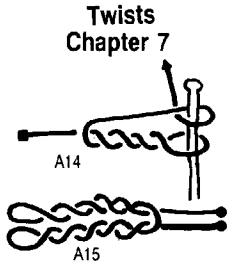
PART 6 A whole set of ways of locating what you want in this book; lists and indexes to help you find your way round the rather unusual arrangement of this book.

Applications, Uses — Illustrations, Knot Names — Concepts, Definitions

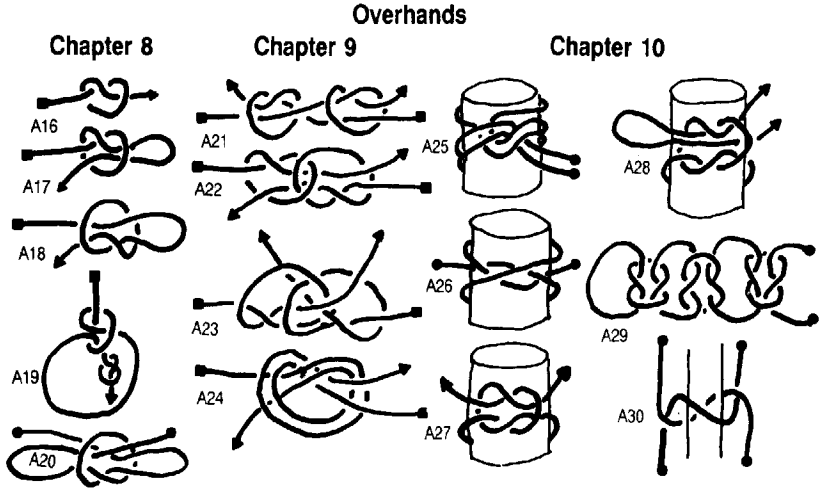
KNOTS WITH DISTRIBUTED NIP

Part Two contains the knots where the nip is distributed throughout the knot, either more or less evenly, or else graduated from a maximum where the rope enters the knot to a minimum either at the other end of the knot or in the middle of it. The more usual examples contain long contact between parts of the rope or between the rope and some other object, such as in a twist (A1) or some other long contact (A2).

The principal division is into the simple twists (A4: Haywire Twist, 45; Chapter 7); the Overhand Knot and its relatives (A5: Overhand Loop, 134: Chapters 8–10); knots involving simple long friction (A6: Lifting Hitch, 210B: Chapters 11–13); and the Figure Eight knots and derivatives (A7: Figure Nine Knot, 280: Chapter 14).



Chapter 7 contains knots with simple twists, either all of the same handedness (A14; Builders Hitch, 46) or of different handedness in different parts of the knot (A15: Catspaw, 50). Some means has to be adopted to keep the twists in place, such as the stiffness of the wire in A4, the Half Hitch in A14 or the hook held in the two bights of A15. In some knots the early twists take up most of the load so that there is little tension in the end. Other knots, specially those with only a limited number of twists, need more secure secure ways of holding the end.

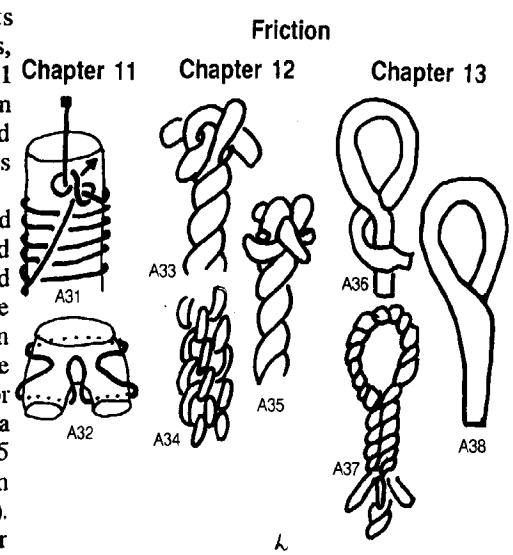


Chapter 8 contains essentially single Overhand Knots: relatively unmodified knots such as A16 (Overhand Knot, 58); knots with the running ends passed back through the central spaces of the Overhand Knots, such as A17 (Slip Overhand Knot, 64); the same formation with the running end and

standing part interchanged, as A18 (Overhand Noose, 77); more complex knots formed when either the running end or the standing part enter one of the other spaces, such as A19 (Honda Loop, 84), where the running end passes back through the running space; finally, the knots forming double or multiple loops by passing either one or both ends back into the spaces of the knot, as A20 (Tom Fools Knot, 97).

Chapter 9 contains knots formed by essentially paired Overhand Knots to form related bends and loops: the two Overhands may be kept separate, though touching, as in A21 (Fishermans Knot, 103); Overhands linked through the central spaces, as in A22 (Two-Strand Matthew Walker Knot, 115) or through other spaces, as in A23 (the Riggers Bend, 128); linked through the running spaces; finally, the Overhands may be completely congruent, as if formed with doubled ropes, as in A24 (Ring Knot, 132).

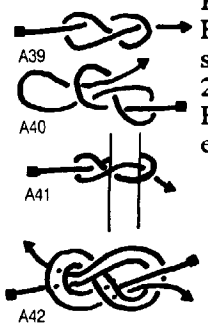
Chapter 10 has Half Knots, where the twist of the Overhand tightens on to an enclosed object: essentially single Half Knots, such as the simple A25 (Overhand Mooring Hitch, 142); and the interesting knots where the Half Knot is trapped under its own twisted up belly, as A26 (Constrictor Knot, 150); paired Half knots, such as A27 (Reef Knot, 165), the one knot almost everyone knows; various slipped versions, such as A28 (Slipped Reef Knot, 177); multiple Half Knots, as A29 (Hobble Knot, 186); lastly, Overhands opened up to enclose another object, which may be other cords, as A30 (Macramé Knot, 200).



Chapter 11 contains knots with friction over long lengths, from multiple turns, as A31 (Lifting Hitch, 210A) or from long contact with an enclosed object, as A32 (Diaper Harness Knot, 222).

Chapter 12 contains strand knots, which may be formed from either the strands of laid rope or separate cords: simple strand knots, like A33 (Crown Knot, 224); repeated knots, like A34 (Crown Sennit, 234); or mixed knots, usually with a capping and a lead knot, as A35 (Stopper Knot, 241, a Crown Knot followed by a Wall Knot).

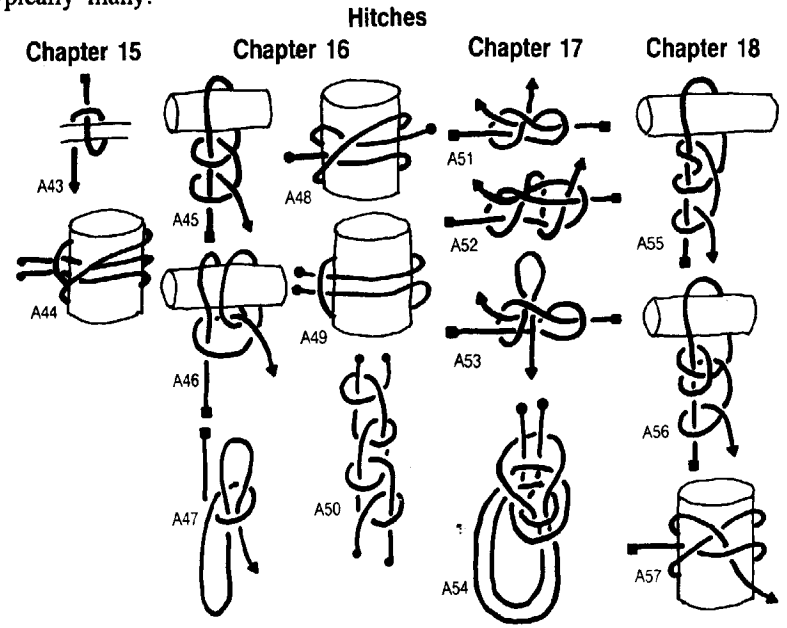
Splices are found in Chapter 13. I include relatively crude splices, where often the wole rope is inserted through the standing part, as A36 (Double Cobblers Splice, 248) with no differentiation of the rope parts; splices with interweaving strands, either in laid rope, as A37 (Eye Splice, 255) or in multiplait; and splices involving the insertion of parts of braided rope, as A38 (Eye Splices, 269, 276).



Finally, the Figure Eight Knots and their derivatives are discussed in Chapter 14; similarities with the Overhand Knot series can be seen. Included in the chapter are: simple Figure Eight Knots, as A39 (Figure Eight Knot, 279); slipped loops and nooses, as A40 (Slip Figure Eight Knot, 286); Figure Eight Knots round an object, as A41 (Eight Hitch, 295); and finally, adjacent, interlocking and congruent Figure Eights, as A42 (Flemish Bend, 313).

KNOTS WITH CONCENTRATED NIP

Part Three contains the knots where the nip is more concentrated at particular points, as in A3, rather than spread out more or less evenly along a length. The principal subdivision is into hitches, as A8 (the Bill Hitch, 398; Chapters 15–18), where there is typically only a few points of concentrated nip, and interweaves, as A9 (a Ring Mat, 493B; Chapters 19–21), where there are typically many.

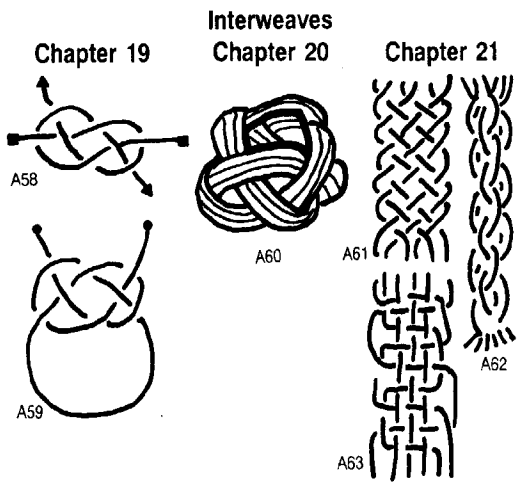


Chapter 15 contains the simpler knots in this series, divided into those tied in a single rope like A43 (Crossing Knot, 318), or tied in a sling or other fixed loop, as A44 (Pile Hitch, 325).

Chapter 16 discusses the many Half and Single Hitches: Half Hitches onto the standing part, as A45 (Two Half Hitches, 337) or passed into a round turn before hitching the standing part, as A46 (Fishermans Bend, 348); isolated Single Hitches, like A47 (Bellringers Knot, 360); Single Hitches in series, like A48 (Clove Hitch, 372); a change of handedness in Single Hitches, as A49 (Cow Hitch, 379); and a whole variety of multistrand multiple Single Hitches, mainly decorative, as A50 (Chain Bar, 388).

Chapter 17 contains the Sheetbends and Bowlines, which can be considered a Single Hitch round a loop with the standing part of the hitch passing through the loop. The Chapter is divided into: simple Sheetbends and Bowlines, as A51 (Sheetbend, 395); ways of securing the knots, as in A51 (Double Sheetbend, 413); other derivatives, such as A43 (Slip Sheetbend, 423); and multiple loop Bowlines, as A54 (Bowline on a Bight, 437).

Finally, the effect of extra tucks and turns on the simple hitches is considered in Chapter 18: adding a round turn under the hitch, as A55 (Midshipmans Hitch, 446); adding a riding turn instead, as A56 (Rolling Hitch, 457); and extra tucks and turns in snug hitches, as A57 (Millers Hitch, 463).



The simplest of the interweaving knots are the Carrick Bends, considered in Chapter 19, containing the simple and capsized Carrick Bends, as A58 (Carrick Bend, 472); and the very similar Josephine Knots, as A59 (Josephine Knot, 482).

Chapter 20 considers Turksheads, as A60 (Four-Bight, Three-Part, Three-Pass Turkshead, actually described in 464). In particular, I describe a general method for making Turksheads of any desired size by working out the design on paper; also how to tighten Turksheads to produce mats and the like (A9).

Chapter 21 discusses a representative selection of sennits, all of which share the property of being easily extended to a variety of numbers of strands. There are flat sennits, like A61 (Six-Strand French Sennit, 499); hollow sennits, like A62 (Six-Strand Round Sennit, 508); and the woven sennits, where some strands, the warps, run more or less straight along the whole length of the sennit, and others, the warps, cross from side to side, as in A63 (Six-Strand, Three-Weft Mounded Woven Sennit, 519).

PART ONE

GETTING READY

The use of knots and rope has been part of the human experience for a very long time. Very many fibres have been used at different times to make rope, and the different kinds of fibres and ways of manufacture form ropes of very different properties. Before use, ropes need preparation and at all times need care in order to give long and satisfactory service. A fair amount of technical jargon has grown up about the use of rope and knots.

Learning to tie knots from books can be difficult unless you have a lot of experience and the book is good. It is best to learn from someone else, but the teacher needs to set about it in an efficient way. Learning to tie knots new to you is often easiest if the knots are learnt in a systematic order, starting with the knots you know and progressing through closely related knots to those more distantly related. In fact, knots are often better and more logically arranged and studied according to their structure than according to the purposes for which they are used. This too often separates widely knots of very similar structure and ways of tying, which means that each knot has to be learnt as a separate exercise in itself.

I look at all these topics in this Part.

Chapter 1
ROPE MANUFACTURE

People have been using vines and sinews, reeds and grasses, hair and bark fibres to connect or bind together various objects and for fishing lines, nets and snares for a very long time, certainly for as far back in the past as the materials themselves have survived. And they have tied knots in them.

Indeed, many animals use similar fibres in their nests. If they have sufficiently dexterous appendages, such as the hands of chimpanzees or the beaks of weaver birds, they also tie simple knots. So it is quite likely that knots have been used by our ancestors since at least the time of *Homo habilis* a couple of million years ago, if not earlier. Beads for necklaces or decoration on clothing have been known for more than 100 000 years; hafted stone tools needing some kind of binding have been known for at least 50 000 years. These dates long precede the invention of agriculture or sailing. Two-strand laid rope forming knots, nets, snares and sennits of uncertain function has survived in Peru for 10 000 years, braided leather thongs for 6000 years in south-west Asia.

Enormous quantities of rope were used in the great days of sail. Hemp from Russia was the main fibre used at first, but the Crimean War and other disturbances cut off supplies and manila from the Philippines replaced it, though it was harder and stiffer. Between the world wars, manila was known as the best fibre available for most general purposes, though the cheaper sisal was made in larger quantities, mainly for rough use in binder twine, clothes lines and the like. Then World War II cut off the Philippine supply and greatly spurred on the development of synthetic fibres, at first mainly nylon, for use in rope. In recent times, synthetic fibres are used for almost all types of line. In general, they are stronger and less affected by water than the natural fibres they replaced, though they are more slippery. Control over the chemical and physical nature of the fibres allows custom-made ropes with almost any properties desired.

THE FIBRES USED IN ROPE

Over the centuries a very large variety of fibres has been used or proposed for use in the manufacture of rope. I shall discuss only those fibres, natural or synthetic, that are commonly used and generally available at the present time.

Natural Fibres

All natural fibres used for rope are composed principally of cellulose, chemically a long chain of linked sugar molecules. Chain length and the presence of other substances varies, and are responsible for the variety of fibres.

Manila is obtained from the stalks of a plant in the banana family, mainly grown in the Philippines. A creamy white to brown lustrous fibre, it is the strongest of the vegetable fibres. It is fairly susceptible to weathering, moisture and fungi, so that it must be dried before storing. It is stiff and heavy when wet, shrinking and weakening a bit. Acids, salts, paints, detergents, fats and some solvents and oils cause deterioration. It is fairly resistant to abrasion and handles fairly well. A large number of knots and splices work well when tied in manila rope.

Sisal is obtained from the leaves of the agave plant, a native of Central America. Similar to manila in many ways, it is whiter, rougher, weaker and more susceptible to rot unless rot-proofed.

Other Natural Fibres: Cotton rope is still used for its soft handling, excellent abrasion resistance and minimal elongation, though it is weak; it is used for decorative items, harness and some sash cords. Flax, jute, hemp and coir are now rare as rope, but still found in some types of twine and in sacking and mats. Cords of silk (based on protein, not cellulose) are sometimes used in decorative applications.

Synthetic Fibres

The molecules of the synthetic fibres are all long chains with few branches. There are a possibilities for controlled changes in the exact chemical composition of synthetic fibres which may alter their mechanical properties. Thus there are several types of nylon, with differing resistance to, for example, abrasion or sunlight, and differing strength and elasticity etc. Research is continuing and new fibres are to be expected.

The original synthetic material is melted and extruded into whatever form is desired.

Multifilament fibres are very fine (50 microns, μm, diameter or less). In better quality ropes, specially those used in life-support systems, the fibres are continuous throughout the whole length of the rope, but in other ropes the fibres, though still very long may be joined with knots. The fibres are usually of circular cross-section. **Monofilament** fibres are coarser (often 250–350 microns diameter) but still mainly continuous and of circular cross-section. **Staple** fibres are discontinuous (a couple of centimetres to a couple of metres long), cut from multifilament or monofilament, but sometimes of non-circular cross-section. **Film** fibres are formed by splitting a flat continuous tape and either giving it some further surface treatment or twisting it.

Compared with natural fibres, all the synthetics are less susceptible to

water, rot and insects, but more susceptible to heat and ultraviolet light; they have a better, sometimes much better, strength to weight ratio.

Nylon or polyamide is the strongest and most elastic of the fibres commonly used in rope making; its strength when wet is some 10% less than when dry. The elasticity allows it to absorb high shock loads smoothly and with very good stretch recovery. Nylon's energy absorption capacity is 8 times that of manila and 27 times that of steel rope. These figures apply to the basic materials. Elasticity and energy absorption capacity of a rope depends largely on the construction of the rope when the load is low; the properties of the fibres become more important as the load increases. Nylon is soft and silky, with a bright lustre; it is often used as multifilament, sometimes as staple. It is resistant to abrasion and to bacteria and most organic solvents, but it is sensitive to strong acids and alkalis, and to prolonged exposure to sunlight. It starts to weaken at about 150°C, softens at 235°C and melts at 250°C, leaving a bead and a sort of celery odour; when removed from the heat source, it will not support a flame.

Polyester (Terylene) is similar in properties to nylon, except that it is not quite as strong (wet and dry strength equal) or as elastic or, compared with some modern nylons, as abrasion-resistant, but has better resistance to acids and sunlight. There is an unexplained weakening after relatively few manipulations. Stretching while hot during manufacture gives a very low-stretch, less elastic fibre. It melts at 260°C, leaving a hard ball and an aromatic odour.

Polyethylene or **Polythene** is very tough and has good abrasion resistance and flexibility down to very low temperatures. It is cheap and light (it floats in water) and does not stretch much. It is used as monofilament or as staple ("silver" rope). It is sensitive to sunlight unless protected by additives. It is resistant to most chemicals and to fungi, and is not affected by water. It starts to weaken at 30°C, softens at 100°C and melts at 110–120°C, shrinking and curling back, and burns fiercely.

Polypropylene is similar in properties to polyethylene, but is lighter, a little stronger but a little less resistant to abrasion and to chemicals. It is used in all forms, multifilament, monofilament, staple and film. It is less resistant to cold, but more resistant to heat, starting to weaken at 40°C, melting at 165°C, with shrinking and curling, but does not ignite readily.

Other Synthetic Fibres have not yet become common but may have specialist uses. New fibres or variants of old ones are being developed and may come into use. Vinylon (polyvinyl alcohol) is fairly similar to nylon and polyester. Kevlar (polyaramid) is very strong and has low stretch but becomes brittle and weakens considerably when subjected to sharp curves, cyclic loads or repeated knotting. Spectra is a sort of reconstituted polythene, and has low density but great tensile strength and high abrasion resistance.

Identifying Fibres

The simplest test to try to identify the nature of the fibres in a rope is to set fire to a small sample. Nylon burns with a whitish smoke, an odour variously described as like fish or like celery; it may melt and drip before catching fire. Polyester burns with a dense black smoke and an aromatic odour, described as like mushrooms; it also may melt and drip before catching fire. Polyethylene (which has a shiny surface) and polypropylene (which has a smooth surface) burn without much smoke or smell, but form molten granules, curling back. It should be noted that some substances added to the chemical mix for the fibre to enhance resistance to light etc may affect the colour of the smoke. Natural fibres char and burn without melting.

CONSTRUCTION OF ROPE

Even when the individual fibres are long enough to do the job, they need to be gathered together in some way for convenience of handling. Because of the shearing action of twisted fibres when fully loaded, a rope is substantially weaker than the sum of the individual fibres. There are two main basic methods of combining fibres into rope.

In **laid** rope the basic elements are twisted together in a hierarchy with change of direction of the twist, but no interweaving. Laid ropes are easy to make by hand, even for long lengths, and simple machinery was developed a long time ago. Early in the industrial revolution the process was completely mechanised.

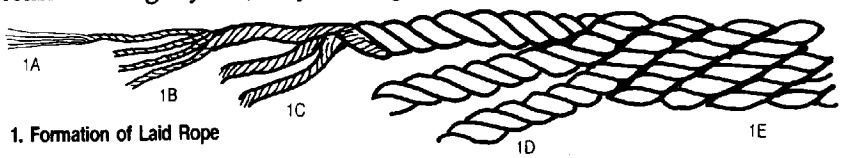
In **plaited** or **braided** rope various patterns of interweaving are followed. The arts of plaiting and braiding have been known for a very long time, but have been little used for making long ropes until quite recently. The process is more complex and complete mechanisation more difficult. The tendency of laid ropes to untwist under load was accepted for most purposes because of the greater cost of plaiting or braiding. The invention of the synthetic fibres changed things. The fine slippery fibres of the synthetics do not hold the twists of laid rope so that it unravels extremely easily for a much greater distance than in plaits or braids. This prompted development of efficient mechanical methods and now plaited and braided ropes are common articles of commerce.

Plaited and braided ropes have a smooth round surface and so will run well over pulleys, and the tendency of many such ropes to flatten over drums makes them hold well on winches. Laid rope is usually stiffer with less stretch, but is slightly stronger than plaited or braided rope of the same size and fibre type. Note, however, that the details of construction of the plaited or braided ropes can change the stretching properties of the rope considerably. In medium-sized laid rope each long fibre gets to the surface at some time, to become subject to abrasion etc. It is easy to inspect the interior of the rope by twisting the strands apart; wear weakens the rope progressively. Most plaited and braided ropes of any size have a core that provides much of the strength and is protected by the sheath from surface damage, but any damage to the interior is hard to detect; wear may have little effect on strength until the sheath is

quite badly damaged. Laid rope has bumps due to the strands that hold knots well; the smoother surface of plaited or braided rope allows knots to slip more readily.

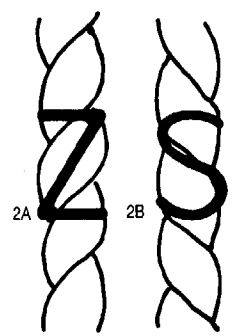
Laid Rope

Before the invention of synthetics, all fibres used in rope-making were staples. If a number of these staple **fibres** (1A) are twisted together, overlapping the ends, the result is called a **yarn** (1B) and it is fairly easy to get quite long lengths using coarse natural fibres. Indeed, some kinds of binder twine consist of single yarns; they disintegrate fairly readily by untwisting.



1. Formation of Laid Rope

If two or more yarns are twisted together in the direction opposite to that of the yarns, **strands** (1C) are formed and these are more stable, less likely to unlay or unravel. More stability again is obtained by repeating the process, twisting the strands together while changing the direction of twist each time. The changes of direction of twist hold the components in place, minimising unlaying. The number of fibres per yarn is usually fairly constant; in ordinary ropes the yarns vary little between large and small ropes, and it is mostly the number of yarns per strand that determines the size of the rope.



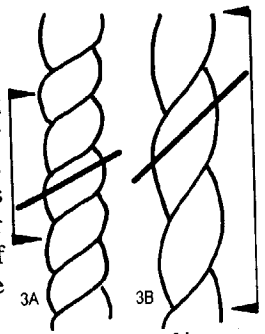
2. Handedness of Rope

Traditionally, yarns have been twisted **right-handed** (in the same direction as an ordinary screw or bolt), also known as **anticlockwise** (if both ends are held, twisting the near end in an anticlockwise direction tightens the twist) or **Z-laid** (a letter Z can be superimposed on the lay, as in 2A). Strands are then twisted **left-handed** (**clockwise** or **S-laid** as in 2B). In some larger sizes of rope, particularly if synthetic, small groups of yarns are twisted together before twisting large numbers of these groups into strands; the original yarns have to be twisted left-handed to finish with right-handed rope.

Hawser-laid rope, the commonest and strongest construction, consists of three strands, laid right-handed (1D). **Shroud-laid** rope has four strands (larger sizes need a core to fill the space in the centre) and **Septin** rope has six strands and a heart-strand or core; these are now rare; five-strand rope was in use early in the last century. These are all weaker but more flexible and elastic than hawser-laid rope. Three hawser-laid ropes can be twisted left-handed to form **Cable-laid** rope (1E), used in very heavy towing ropes. Further twisting of cable-laid ropes together has been recommended for large sizes of rope made from coarse grass; it is very springy.

Left-handed laid rope has been made for special purposes, but is rare. The yarns are twisted left-handed, the strands right-handed.

Ropes can be **hard** or **soft**-laid, that is twisted tightly (with a large **angle of lay**, relative to the long axis, but a short **length of lay** or **jaw**, along one 360° turn, as in 3A) or loosely (with a small angle but long length of lay, as in 3B). Soft-laid ropes are stronger (the curves in each fibre are gentler), and they stretch less under light to medium loads since there is less twist to straighten out. Hard-laid ropes wear better (there is less motion between fibres and the effects of a single broken fibre do not spread so far). Knots are more secure in soft-laid rope.



3. Tightness of Lay

Commonly, the same kind of fibre is used throughout the rope, but recently some large ropes have been made with the inner and outer yarns of each strand of different fibres; a special method of laying the strands has had to be developed to keep the two groups separate. An example has inner yarns of multifilament polyester for strength and the outer yarns of staple polyethylene for special surface properties.

Making Rope: it is worthwhile to get familiar with the system of laying ropes. This knowledge helps in re-laying rope that has unlayed a bit, and in tying strand knots and splices. It is best to practice with natural-fibre rope, preferably manila, though synthetics in staples are not too bad. Start by unlaying the rope for a short distance, taking care to keep the strands intact (bind them with some sticky tape, or use a Constrictor Knot (150) in twine, or for synthetics, heat-seal the ends). Then take a strand and give it a twist in the direction of tightening it and lay it back in place. Repeat with each strand in turn, a little at a time, until the rope is re-laid. A little practice will allow you to return the rope to its original state. For re-laying long lengths it is often better to clamp the standing part and lay up two strands together, putting appropriate twists in the lay, and then lay in the third strand; or get help or a machine to lay in all the strands at once, with each strand twisted in the direction of tightening while the standing part is twisted in the direction of tightening it.

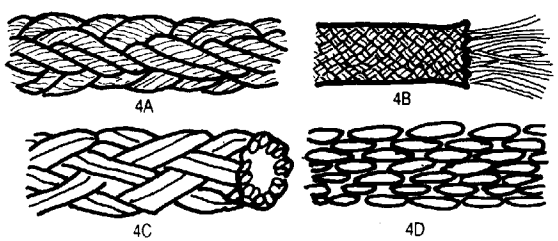
The next stage is to make some hawser-laid rope from ordinary one-ply sisal binder twine, which corresponds to a single yarn. First make three strands from an equal number of yarns (two or three is easiest). For each strand, take each yarn in turn, twist it in the direction of tightening it and lay it in place, continuing with each strand in turn to the end. If, as is common, the yarns are twisted right-handed, the strands will be twisted left-handed. Then lay the three strands together as before. This is a bit trickier than just re-laying unravelled rope, because the yarns and strands do not have the "memory" of where to go. If you want to make up any length in this way, it is much more convenient to have help from several people and perhaps some simple gadgets.

Finally you might like to make rope starting from raw natural fibres—long grass is often the easiest to obtain, though it makes a pretty large-diameter rope and needs a lot of grass and a number of helpers. First make the yarns, overlapping the ends of the fibres and keeping the diameter of the yarns as even as you can. Then make up strands and rope as before.

Other natural fibres that can be used to make rope include sedges; the midribs of the leaves of palms, bananas, plantains or pandanus; the inner bark of many trees, from elms to stringybarks; some roots, nettles, rattans and young bamboo shoots. Of course, except in real emergencies, take care not to cause serious damage to living plants. Sometimes these materials need to be soaked in water for a day or two and bashed to soften and separate the fibres, and some stiff fibres can be softened by passing over a fire. Test for suitability by joining two lengths in an Overhand Bend (130) and pulling the ends apart: the fibres snap readily if too brittle, or slip out if too slippery. Making a long rope single-handed is tricky; often a plait such as a four-strand Round Sennit is easier and nearly as suitable.

Plaited or Braided Rope

These terms are often used interchangeably, but strictly a **plaited** rope is based on the Round Sennit (508) or some simple variant and the parts spiral round the rope, half right-handed, half left-handed (4A–4C). On the other hand, a **braided rope**, strictly, is based on the Crown Sennit (234) or a variant, and on the surface the parts are parallel with the rope (4D) but in the interior they all twist round the rope in the same direction, usually right-handed. The load in these two types of rope is distributed among the fibres quite differently, giving different properties to the rope. It is unfortunate that a clear distinction has not been maintained in the names.



4. Plaited and Braided Rope

Four-part plaits (4A) (sometimes known as **multiplait, square rope, 8-strand** or, a little ambiguously, **8-plait rope**) do not usually have a core. They have four parts, each of two strands; two of the parts have each strand laid left-handed, the other two have each strand laid right-handed. Plaits or braids with a larger number of parts (4B) commonly do have a core, except for the eight-part **hollow plaits** (4C) which are mostly made in monofilament polyethylene and used where large size but no great strength is wanted.

Synthetic ropes with a plaited sheath round a core (the **core and sheath** construction) are becoming more common.

The individual parts of the plait or braid may consist of single yarns, loosely or tightly laid, or of two or more yarns that stay parallel throughout the

plait, or they may be of more complex construction. The structure of the core also varies a lot; parallel fibres, single or many parallel yarns or strands or plaited yarns are commonest, but again more complex constructions are found. Though usually made of the one fibre, sometimes the core and sheath differ.

The core and sheath construction, in particular, allows a very wide variety in the properties of the finished rope. The chemical composition and size of fibres and the type and tightness of weave of both core and sheath make a lot of difference. The sheath's main function is to provide the surface properties of the rope, resistance to abrasion or sunlight, friction and feel. The core usually provides most of the strength and nearly all the elasticity, though some double braid ropes have core and sheath contributing roughly equally to the strength of the rope.

Core and sheath ropes used by sailors mostly have a fairly tightly plaited sheath over a loosely plaited core and are known as **double braid** or **braid on braid**. Other ropes used by sailors and others have different cores, often a laid strand (1C) and, depending on construction, are called **single braid, 8-plait** or **16-plait**. Depending on the materials and construction, a wide range of mechanical properties, specially elongation, can be built into the rope. Usually it is possible for the sheath to slip along the core during use for a significant distance. Satisfactory splices can be made in nearly all these ropes.

The ropes used by climbers, cavers and rescue workers for life support are known as **kernmantle**. This was the original German term for any core and sheath construction, but is now restricted to ropes constructed with a plaited sheath over many small yarns (1B) or strands (1C); in some ropes half of these are twisted left-handed, half right, to minimise spin of the rope. This construction allows close control of the physical properties of the rope; two main types of rope are in use. **Dynamic** ropes are used for safety; in normal use they are unloaded, but they are intended to hold in reasonable comfort falls of a few metres such as occur occasionally in climbing. Elasticity of the rope is important to minimise the jerk of stopping the fall. Almost always now, the core consists of many tightly laid strands (that can therefore stretch a lot by lengthening the lay under medium loads) tightly packed in a sheath designed to stretch with the core under heavy load. **Static** ropes in normal use take the full weight of the person on the rope, and only very rarely need to withstand more than a very short fall. Stretch under normal loads is undesirable and there should be no spin. The core consists of many very loosely laid strands or yarns tightly packed in a sheath designed principally to provide protection from abrasion. In both these types of rope, sheath slippage is minimal. No splice has yet been devised that maintains the strength of the rope.

When these ropes are loaded, the first thing that happens is that the strands or yarns lengthen like a coil spring. The tight lay of the dynamic ropes allows a lot more stretch than the loose lay of the static, so that they can absorb much more of the energy of a shock load. When the strands approach the limits of this sort of movement, further elongation of the rope becomes more and more

dependent on the stretching of the fibres themselves.

An example shows the difference between these two types of rope. Some years ago a particular manufacturer made both kinds of rope, both of nylon, much the same in appearance. They had similar breaking strengths, around 2.5 tonnes, they had roughly similar elongations at failure, 30% for the static rope, 50% for the dynamic. But the elongation under the load of a single person was very different, 2% for the static rope, 8% for the dynamic, so that if anyone started to climb up a rope from the bottom of, say, a 100 m drop there was only 2 m of slack to pull in on the static rope before the rope would support the person, but 8 m on the dynamic, which also would have given a very bouncy climb. Other ropes may have somewhat different specifications.

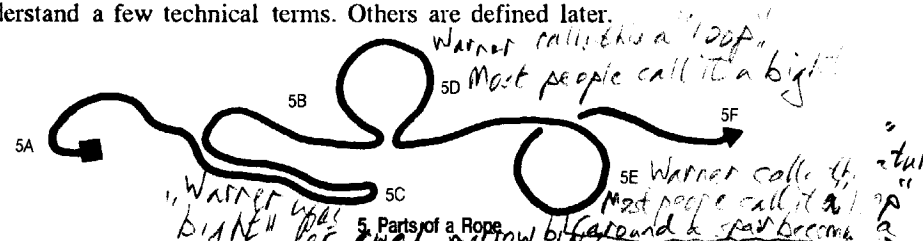
It is clearly impossible in a book such as this to list all the various types of rope and their properties, or to list all the applications and their appropriate rope types. The user should consult the rope manufacturer or experienced users in the field of interest.

Chapter 2
PREPARATION OF ROPE

If a rope is simply cut, the two ends unlay or unravel, sometimes for a considerable distance, so the ends must be protected in some way. Then the rope must be coiled in some way for storage or transport, or the whole rope tangles up.

SOME TERMS USED IN ROPEWORK

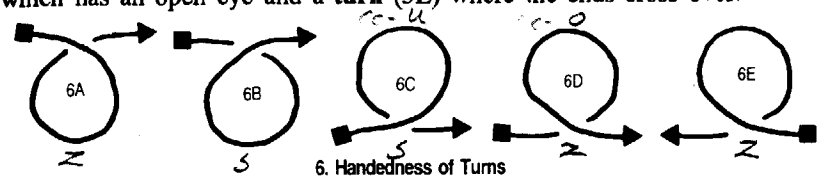
Before we discuss the preparation of rope for use in knotting we need to understand a few technical terms. Others are defined later.



5. Parts of a Rope

Most knots are made using only one end of the rope (or of each rope if joining two ropes). This end is called the **running end** (5F), though other names are used. The other end of the rope, the end you are not working with,

is called the **standing end** (5A). In this book, the running end is marked with a triangle or arrow, and the standing end, or as near to it as the drawing shows, is marked with a square or bar; a circle is used to mark both ends when it doesn't matter which is which. Any part of the rope between the two ends may be called the **standing part** (5B). If you pick up a bit of the standing part, allowing the ends to hang together, you are holding a **bight** (5C). If you tie a knot using the doubled rope, you are tying it **on** (sometimes **in** or **with) the bight**. Sometimes it is said that a knot is **tied in the bight**, meaning without access to the ends. A bight must be distinguished from a **loop** (5D) which has an open eye and a **turn** (5E) where the ends cross over.

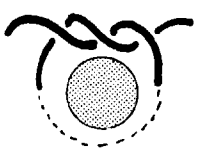


6. Handedness of Turns

A turn may be made in either of two directions. A **right-handed** turn (6A), turns in the same direction, clockwise going away from you, as an ordinary laid rope, screw or bolt. Note that 6D and 6E are also right-handed turns; 6D is also called an **Overhand Turn** from the way it is conveniently tied by a right-handed person. A turn in the opposite direction is a **left-handed** turn (6B, 6C); 6C is also called an **Underhand Turn**.

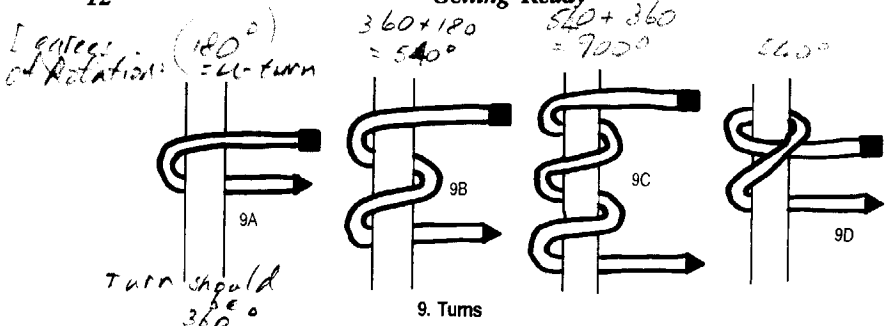
7. Handedness of Overhands

If, after making a turn, the running end is passed round the standing part and through the turn, the result is called an **Overhand Knot** (see also 58); 6A becomes 7A, 6B becomes 7B and so on. The Overhand Knot is also **right-handed** (7A, 7D, 7E) or **left-handed** (7B, 7C), according to the handedness of the basic turn, which also is the handedness of the twist of the knot. Sometimes, though not always, if the Overhand Knot is tied round an object, or if two ropes on either side of an object are joined by an Overhand Knot over it, the result is called a **Half Knot** (8).


8. Half Knot

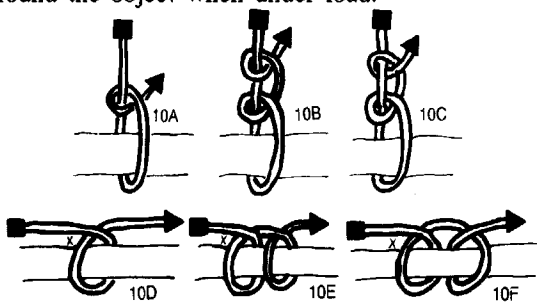
In practice, the handedness of turns and Overhand Knots is usually chosen for personal convenience; of course, the handedness of the parts of a complex knot should match. The efficiency of a knot tied in or on laid rope may vary when tied with or against the lay but the difference is usually minuscule. Whenever the difference is more important in the knots I describe below, I call attention to it.

There is another sense to the word **turn**. If you pass a rope behind an object and bring it back parallel to its own standing part, you have made a



9. Turns

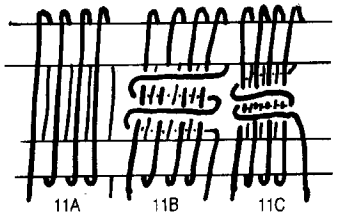
turn (9A). If you take the rope round the object again, you have a **round turn** (9B). If you repeat the action, you have **two round turns** (9C) and so on for extra turns. If when making the round turn you allow one part of the rope to pass over the other, you have a **riding turn** (9D). Riding turns are used to lock the rope but should be avoided if you wish the rope to move smoothly round the object when under load.



10. Half Hitches

A **Half Hitch** is tied by making a turn so that the running end is trapped by its adjacent standing part. It may be made by taking the rope round an object and making the Half Hitch round its own standing part (10A), typically worked hard down on to the object; or it may be tied round the object, typically worked hard up against a second object X (10D); X is often other ropework, such as a lashing. **Two Half Hitches** are made in the same way, with both half hitches of the same handedness (10B, 10E); if the half hitches are of opposite handedness, the knot is a **Bucket Hitch** (10C, 10F). Note that the first half hitch is tightened down on to the object before the second is tightened down on to the first. A Bucket Hitch cannot be made as tight as Two Half Hitches because the half hitches work against each other. The Clove Hitch (372) is similar to Two Half Hitches, and the Cow Hitch (379) is similar to the Bucket Hitch, except that they are tightened differently, by making the complete knot and then tightening by pulling on both ends at once. Another distinction is sometimes made between a **Single Hitch**, made on an object such as a spar as in 10D but not necessarily hard up against anything, and a **Half Hitch**, made on its own standing part, as in 10A. In this way, a Single Hitch is half a Clove Hitch and if the object it is tied round is removed, it spills to a simple turn, whereas a Half Hitch is half Two Half Hitches and if the object is removed the knot capsizes (30) into an Overhand Knot.

Returns (11A) are ropes passing from one object to another. **Frapping turns** (11B) are made round previously made turns to pull them tight. Note how the frapping turns are started to give a direct pull; if they are made with the opposite handedness (11C) the initial pull is at an angle and is inefficient and liable to slip and loosen.



11. Returns and Frapping Turns

WHIPPINGS

If a rope is cut it will fray, unlay or unravel when handled unless something is done to prevent it. It is usually most satisfactory to **whip** the ends, that is, bind them with twine as described below. The alternatives, also described below, are best regarded as stopgaps even if they are longlasting.

Alternatives to Whippings

Bind the end with sticky tape—sticking plaster from the first aid kit or electrician's insulating tape are usually better than stationer's tape—but it won't stand much handling and heat or water may damage the adhesive. A heat-shrinking plastic sleeve is better. An Overhand (58) or other stopper knot or a Back Splice (245A) will last, but produces a more or less clumsy knob on the end, which of course is sometimes desirable. A twist of stout wire or a metal swage are similar but may have or develop dangerous cutting ends or edges. A quick-drying plastic cement, nail polish or paint may hold things together for a while, and have been used to hold a taper in the end. All of these are usually best replaced with a whipping as soon as convenient.

Synthetic ropes can have a molten end. Cut the rope with a very hot knife, chisel or electrically heated blade or wire, or hold the end in a flame (cigarette lighter or gas flame better than a match) or against a hot plate. It is important to have a neat end, with neither a knob, a point or a raised edge, which may cut your hand in use. One way to achieve this is to bind the rope tightly with paper, cut through with a sharp knife and melt the end in a small flame while the paper still holds the strands together. Or mould the cooling molten end using a knife blade or wet fingers (be careful—allow time for the end to cool a little). Such a molten end can be quite satisfactory for a while, but often the blob cracks after a lot of handling and then presents a cutting edge or allows some unravelling. So it is best to back up with a whipping.

Another emergency whipping is to use twine to make a Constrictor Knot (150) at the end. This will withstand some but not a lot of handling.

Whippings

A whipping needs **Whipping Twine**. Commercial whipping twine is best, but any strong twine of appropriate size that will not rot will do. It is best

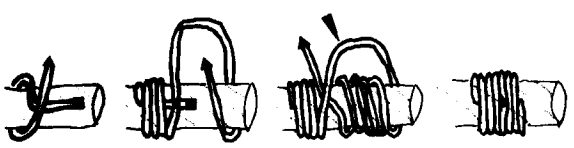
waxed to allow the turns to work tightly together and to hold them in place while tying. Beeswax is best, paraffin or candle wax will do, even soap is better than nothing. Pull the full length of twine, which may be already threaded on the needle if you are using one, in a curve over the wax several times. As an alternative to waxing, some use PVA woodworking glue; either treat the twine and complete the whipping before it dries or apply the glue to the completed whipping; the glue washes out in time if the rope gets wet. Commercial whipping twine is often pre-waxed.

The length of a whipping should be approximately equal to the diameter of the rope, and ideally this should be achieved in around 10–15 turns of the whipping. If the whipping twine is so thin as to need many more turns than this, use it doubled or get thicker twine. The completed whipping should be about one rope diameter back from the end. All the turns should be pulled as tight as possible, taking care not to let them slack off as you make the next turn, or to ride over preceding turns or leave a gap. It may be convenient to use a Marlinespike Hitch (91I) with an appropriate lever to help tighten the turns. If the twine breaks, get stronger twine.

Many whippings have been described. I show a Common Whipping, which is neat but hard to get really tight; the West Country Whipping which can be made tight but its raised parts and the final Reef Knot are untidy and readily damaged by abrasion; and the Palm and Needle Whipping which is probably the best of all but needs a needle, preferably a proper triangular sailmakers needle, a sailmakers palm or other means of pushing the needle through the tightly bound rope and often some pliers to extract the needle from the other side.

When whipping laid rope, the turns should be made against the lay, so that any tendency of the rope to unlay will tighten the whipping. That is, if you are tying the whipping from left to right on right-handed rope, you make the turns over the rope going away from you, under it coming the other way (see 12). This is not important when whipping plaited or braided rope, but this direction is often still convenient, at least for right-handed persons.

Common Whipping



12. Common Whipping

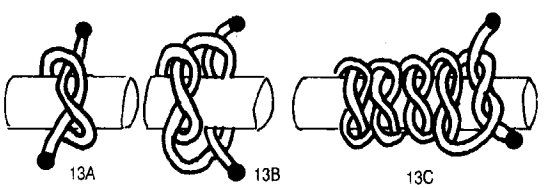
Starting about two rope diameters back from the end, lay a short length of the whipping twine along the rope, pointing to the end. With the rest of the twine, take a turn round the rope, riding over the end (12A). Continue taking turns round the rope, pulling all turns as tight as possible and close together until only four or five turns are needed to complete the whipping. Holding the completed part of the whipping tight, take a loose wide turn (12B). Take four or five loose turns back towards the completed whipping without changing handedness (12C). Using the loop (arrowed in 12C) make four or five tight and close turns over the running end and hard up to the already completed turns, unwinding the loose turns as you go. Pull the running end tight, taking care to work out all the slack. Trim the end off flush (12D).

It is easy to make this whipping much longer, though it is then hard to keep tight throughout its length. Such a long whipping may be used to bind a split stick or cover over an untidy section of rope.

Some books describe a variety of Common Whipping in which the ends are interlocked and pulled under the whipping. The turns must be kept relatively loose so that the interlock may be drawn under the turns. I have yet to find such a whipping on rope of less than 10 mm diameter that cannot be pulled off by hand, and it is not recommended.

In all Common Whippings, if one turn of the whipping is cut or broken, the whole whipping comes off, unlike the other whippings described here.

West Country Whipping



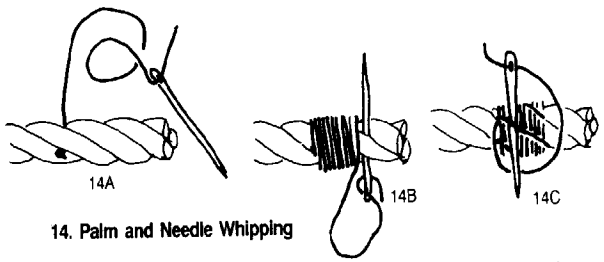
13. West Country Whipping

Starting about two rope diameters back from the end, make a Half Knot (Overhand Knot: 8) round the rope in the middle of the twine (13A), pulling as tight as you can. Take the two ends behind the rope and make another Half Knot (13B), keeping close to the previous turn and pulling tight. Continue to the required length, alternating with the Half Knots on opposite sides of the rope, and finish (13C) with a Reef Knot (165), trimming the ends but not too close to the Reef Knot. The whipping is neater if the Half Knots are all of the same handedness.

If the whipping twine is slippery so that the individual Half Knots are difficult to keep tight whilst making the next, use instead the Surgeons Half Knot (149) and finish with the Surgeons Knot (173) or Double Surgeons Knot (174).

Palm and Needle Whipping

Thread the needle and tie a Thumb Knot (58) in the end of the twine, doubled if necessary, or make a stitch or two through the strands. Pass the needle deep through a strand (14A) and pull the twine tight. If the rope or twine is slippery, pass twine over the next strand and through the third to come out next to the Thumb Knot. Then make the necessary number of turns, close and tight, and pass the needle deep through a strand close up to the whipping (14B) and pull tight. Then make frapping turns by passing the twine back over



14. Palm and Needle Whipping

the whipping covering the groove of the lay between the strands, through the next strand below the whipping, and up over the next groove, through the next strand above the whipping, and down over the next groove and through the last strand, pulling tight all frapping turns. Finish by passing the needle in the opposite direction under the adjacent frapping turn (14C) and pull tight, working the half hitch well into the groove. It is often a good idea to then pass the twine right through the centre of the rope at the standing part end of the whipping, possibly several times. Trim the end. Properly tied, this whipping should last until the twine wears through.

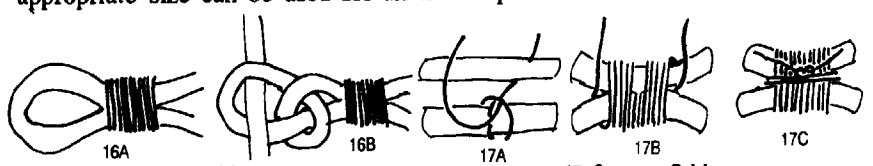
This whipping may also be made on plaited or braided rope, making 3, 4 or 5 frapping turns, slanted as if along the lay, so that it appears as in laid rope. The finish may need an extra tuck or two through the rope before and after the half hitch, because the latter cannot be so well protected.

15. Sewing Ropes Together

A somewhat similar method is used for **Sewing Two Ropes Together** (15), used to reeve new running rigging or flag halyards through pulleys etc that are out of reach; of course, it will not hold any significant load. Butt the two ropes, make short Palm and Needle Whippings on each end but take the frapping turns in diamond fashion between the ropes. I assume that the ropes are already satisfactorily whipped.

Seizings, Mousings and Servings

These are all similar to whippings, indeed in many cases an ordinary whipping may be used with little if any modification. Whipping twine of appropriate size can be used for all these operations.

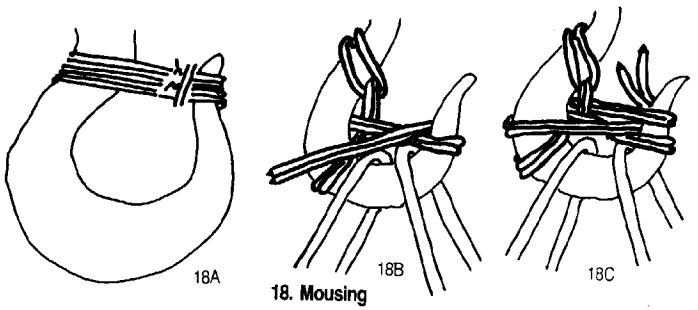


16. Seizing
17. Common Seizing

To **seize** (16) a rope is to bind it with twine to another rope, usually its own standing part. This can be used instead of an Eye Splice to form a loop (16A), though it is not nearly as strong (see the Sewn Splice, 246) or to give extra security to knots (16B) such as the Fishermans Bend (348) or Carrick Bend (472). Common or West Country Whippings can be used as seizings; the desirable length is the combined diameter of the two ropes. The traditional **Common Seizing** (17) is started by making a Clove Hitch (372) in the middle

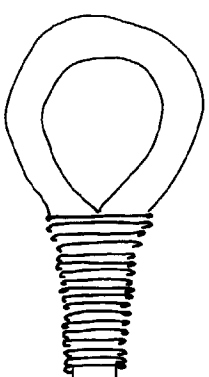
of the twine round the standing part (17A). Take the necessary number of turns with each end in opposite directions, keeping the turns tight, and pass the ends between the two ropes to the same side of the rope (17B); complete a full frapping turn with each end round all returns and join the ends (17C) with a Reef Knot (165).

To **mouse** (18) the mouth of a hook is to bind twine across it to prevent any rope held on the hook, which should fill the mouth of the hook, from jumping out. To hold a mousing the hook must be properly machined so that the mousing, if properly tight, cannot slip off.



18. Mousing

It is tied in a very similar way to the Common Seizing; start with a Clove Hitch in the middle of the twine at the back of the hook. Take each end four or five times between the back and the beak of the hook; make frapping turns round all returns close to the beak and finish with a Reef Knot (18A). If the hook is not properly shaped, or the rope smaller than the mouth, there is danger of the mousing slipping off or of the rope jumping out of the mouth. Some improvisation may then be needed; a solution that often works is to start with a Cow Hitch (379) in the middle of the twine round the back of the hook just before the hook widens and, using the doubled twine, place Half Hitches either side of the rope (18B). Then make a few figure eight turns between the front and back of the hook over the rope. After making the last turn round the beak of the hook, separate the two ends of the twine (18C) and make two frapping turns with each end, in opposite directions round all previous returns, and towards the back of the hook; finish by joining the ends with a reef knot around the back of the hook. The exact design of this Mousing must be adjusted to suit the circumstances and make it impossible for the mousing to slip up the hook.


19. Serving

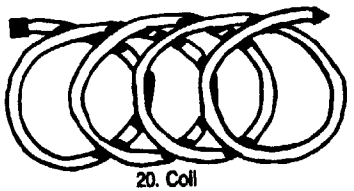
To **serve** (19) a rope or other object is to bind twine round it; the traditional parcelling of a rope was to worm (pass cord along the grooves between the lay to make the surface more smooth), parcel (wrap with spiral turns of canvas) and serve (bind to hold everything in place); the

traditional rule was worm and parcel with the lay, turn and serve the other way. This protects the rope from chafing. A serving can also be used to cover the exposed ends of a splice, specially of wire, or to bind a split fishing rod or ski stock. A long Common or West Country Whipping can be used as a serving, the first looking neater, the second being more secure. If the serving is needed to add to the strength of the construction, as in some eye splices, you really need a serving mallet, a device that allows you to wrap the twine very tightly over considerable lengths in a Common Whipping or similar structure.

COILING ROPE

Rope needs to be properly coiled for storage and transport if it is to be kept free of kinks and snarls. Kinks in rope seriously weaken it, maybe by as much as a third, and a kinked rope may become unusable if repeatedly loaded. The rope must be free of kinks both in use and in storage, which may raise problems.

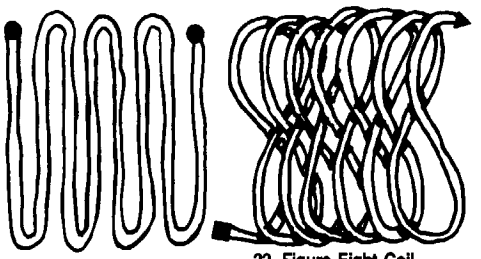
Shorter ropes are usually coiled in a form which can be readily transported and stored on a shelf or suspended from a hook; the coils may be made in the hand if the rope is light enough, otherwise on the ground. The practice of coiling the rope round the hand and elbow, or the feet and knees makes it difficult to keep the rope free of kinks, though it is more satisfactory if a Figure Eight Coil (22) is made in this way. Longer lengths of rope, heavy hawsers and chain are usually coiled where they are wanted, or on to a pallet or in a box for transport and storage. Very long ropes may be better put on a reel, rather than coiled. Large hawsers of multiplait rope are usually very flexible and, like chain, may not need coiling, just flaking down.


20. Coil

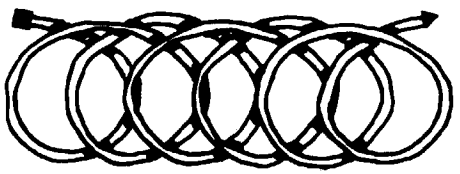
The simplest way to **coil** rope in a kink-free state is to make a series of neat turns, shown opened out in 20. Laid rope should be coiled against the lay, that is, right-handed rope is coiled clockwise from the far end to the near; it is often convenient to coil plaited or braided rope in the same way. Each turn of the coil should be made carefully so that it lies flat and neat against the rest, without any tendency to twist. Often it is necessary to give a slight twist to the rope as the turn is laid, most frequently in a clockwise direction. With long ropes it may be necessary to work these twists to the end of the rope from time to time.

Unfortunately, when you withdraw rope from such a coil kinks will form, which may be removed by letting the rope hang free or by working them down to the end of the rope, which can be tedious if the rope is long. Alternatively, instead of coiling the rope it may be **flaked down**, laid down in a series of neat parallel zigzags (21); if the rope is too long for the space available, a

second series of somewhat shorter zigzags may be laid down on top of and at right angles to the first, and the process may be repeated. Or the rope may be made into a **Figure Eight Coil** (22), either overlapping the turns as shown or, if the rope is not too long, placing them on top of each other. In both these formations the rope turns alternately right-handed and left-handed, so it is easy to keep kink-free. While it is possible to suspend a Figure Eight Coil, it is undesirable as a tight turn is formed under gravity at the bottom; both these formations should be made and stored flat.

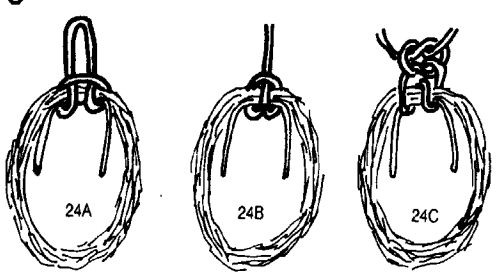

21. Flaking 22. Figure Eight Coil

A suspendable coil that is kink-free in storage and allows the rope to be withdrawn kink-free is the **Kink-Free Coil** shown opened out in 23. Make the turns of alternating handedness (another way of saying this is: make alternately turns and Half Hitches), giving the slight twist to the end to make the coils hang free without any tendency to twist. After a little practice, this becomes a simple and quick method of avoiding kinking problems.


23. Kink-Free Coil

Coils with Separate Bindings

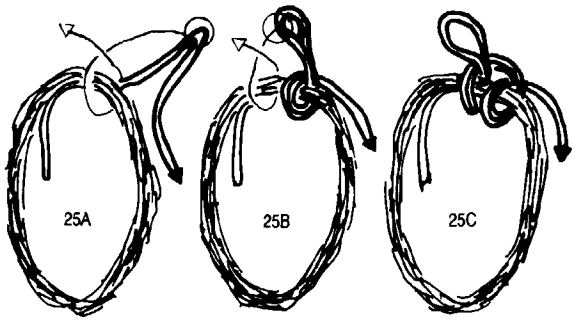
Ideally, rope should be stored without any knots or constrictions in it at all, but some kind of binding is often needed for convenient storage or transport. A continuous loop of rope or **sling** (24A) may be used to hang the coil over a hook, or a rope with an eye at one end, or **snotter** (24B) may be used to tie the coil to a beam, but neither is satisfactory for storage on a shelf or storage or transport in a bag or box. A short length of rope may be **bound** (24C) round the coil, making a few turns and making fast with a Reef Knot (165) or Slip Reef (177), or perhaps using a Slip Constrictor Knot (151). Large sizes of rope or very long lengths may be made into large coils on the ground and bound in several places before storage or transport.



24. Separate Bindings

Self-binding Coils

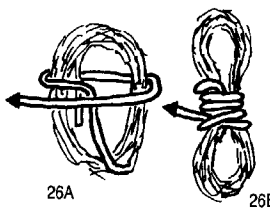
The trouble with separate bindings is that the binding is too apt to get



25. Hanging Coil

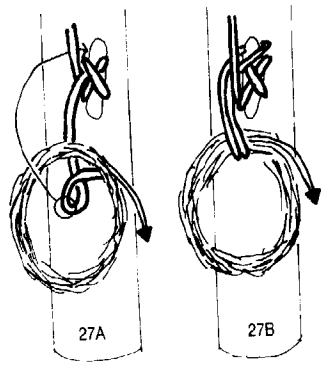
misplaced when not in use and is often a nuisance to carry round. So there are many ways of using the rope itself to bind the coil.

If you are going to hang the coil over a hook, use a **Hanging Coil** (25). Make the coil and take a bight of the running end (25A) and ride the bight back over its own standing part (25B) and make two Half Hitches with it tight round the section of the coil (25C). The loop of the bight may then be placed over the hook.



26. Rope Hank

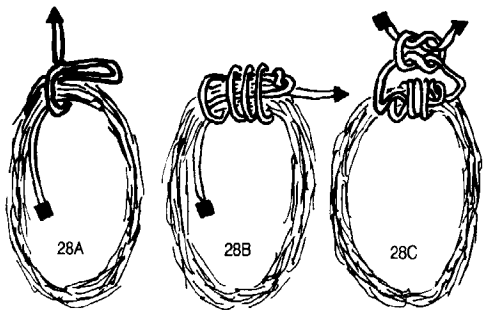
For short and medium lengths of rope, up to about 2000 times the diameter (i.e., the length of the rope in metres is no more than about twice the number of millimetres in the diameter) it is often best to make **Rope Hanks** (26) which can be stored on a shelf or in a bag etc. Coil the rope, leaving a suitably long end. It seems to be a natural tendency for many people to make the coil much longer than is desirable, so that it is sloppy and does not hang together well. Except for very short lengths of rope, it is best to have between 10 and 20 turns in the coil, so that the length of the coil is no more than about 40 times the rope diameter. Take a turn round the coil with the running end, riding over its own standing part (26A) and pulling tight. Make some more tight turns (not less than 3, preferably not more than 8) and finish with a Half Hitch (26B) pulled tight. If the bundle has been properly made, it should withstand vigorous handling.



27. Halyard Coil

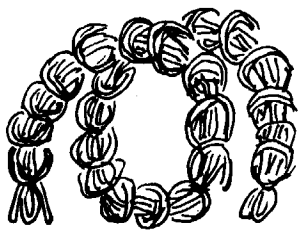
If you have made fast a rope to a cleat and have a long length left over, it can be made into a **Halyard Coil** (27). Coil the running end and then bring the standing part the lead from the cleat) in a bight into the middle of the coil and behind it (27A). Take the bight over the coil and twist it to cast a Half Hitch over the cleat (27B), passing behind the halyard. If you have a length coming down from above which you wish to coil out of the way and there is no cleat available, you may use a Bellringers Knot (360) for shorter lengths or a Bowline on a Coil (442) or a Bowline on a Skein (439) for longer lengths or greater security.

Long ropes such as climbing ropes may be coiled in a **Climbers Coil** (28), which can be carried over the shoulder. Coil the rope to a suitable length, make a bight with the running end (28A) and pass the end round the section of the coil. Take the end round the coil, riding tightly over the bight for at least three or four turns and pass the end through the bight (28B). Tighten by pulling the other end of the bight until it traps the running end. In stiff ropes that may not hold firm, tie the two ends together over the frapping turns (28C) with a Reef Knot (165) or a Secured Reef Knot (169). The coil may readily be stored on a shelf or in a bag or hung on a broad beam.



28. Climbers Coil

Instead of making round coils, it is often convenient to make **Chained Coils** (29). Double or quadruple the rope (thin cord can be worked in 8s or even 16s) and tie a Chain Sennit (75). This will withstand a lot of handling and can be stored in a bag, on a shelf or hung over a bar; it is unlikely to tangle when uncoiling. A Chained Coil may also be used when washing a rope by machine (see below). A somewhat similar arrangement is to make a few turns of a coil and use the remainder to cover the coil right round with a Chain Serving (76).


29. Chained Coil

Uncoiling Rope

There are no problems in uncoiling a short length of rope, but even if you have made proper coils, long lengths may give trouble such as kinking or tangling if you are not very careful. Rather than trying to take the rope straight out of the coil into use, it is best to uncoil into a loose stack, possibly in Flakes or Figure Eight Coils, and deal with any snarls and kinks as you make the stack. Take care that the standing end is kept well clear of the stack so that it cannot become entangled as you withdraw rope from the finished stack. It is also possible to make the stack in a large bag. The standing end must hang well out of the bag, separate from the running end. Such a bag of rope will not withstand a lot of handling without disordering the stack.

If in uncoiling a rope you come across a big tangle, called a "bunch of grapes" or a "bird's nest", do not pull hard on the end, you will only jam the whole tangle. Arrange the tangle so that the longest end comes out of the centre of the heap. Enlarge the entrance hole carefully and slowly turn the heap inside out, keeping the end central as you pull it out. Continue the proc-

ess, untying any knots that appear, and, with luck, you will disentangle the whole thing.

Uncoiling New Rope

If you have a new coil of rope, lay it flat on the floor and cut the bindings but do not remove the wrappings. Withdraw the rope from the centre of the coil in an anticlockwise direction (for right-handed rope). It is usually clear which is the right way up for the coil, either from a label on the wrapping or a tag on the rope end. Rope withdrawn in the wrong direction kinks badly. If this happens, push the rope you have withdrawn back into the centre of the coil, turn the coil over and pull the rope out from the other end. If you only want part of the coil, keep the remainder of the rope in its wrapping and treat carefully so that it doesn't collapse; keep it right way up so that when you start withdrawing rope again it will be in the right direction.

If your new rope is on a spool or drum, suspend it on a bar and unreel the rope, letting the drum revolve freely.

It is often recommended that a new rope, specially if of natural fibre, should be put under a tension of about the safe working load, before putting it to real use. This allows the fibres to work together and reach an equilibrium, perhaps after unlaying a trifle.

Chapter 3
CARE OF ROPE

Abused rope won't last long and may become dangerous without showing any obvious signs. So look after it. Rope that has deteriorated should be discarded or confined to light or unimportant loads. If it is not too worn, it may make good practice knotting rope.

Environmental Causes of Deterioration

When exposed to heat, synthetic fibres first soften, become deformed and lose strength; remember that the heat can come from friction between the rope and something else. These effects of heat occur at quite low temperatures with polyethylene and polypropylene, but at higher temperatures with nylon and polyester. If heated further the rope melts and eventually catches fire. Natural fibres become brittle and then char before igniting. All ropes therefore need to be kept from hot surfaces, welding operations or radiant heat. Temperatures down to –30° C do not affect rope provided that it is dry.

Direct sunlight damages rope, specially natural fibres. Polypropylene is the most susceptible of the synthetics, though stabilisers can delay damage. With laid ropes, thin ropes are most susceptible, because most of their yarns are on the surface.

All ropes are damaged by strong chemicals, acids, alkalis, solvents, oil or grease; polyethylene and polypropylene are most resistant. Washing compounds and paint are also deleterious, as are contact with rusty metals or animal excreta. If contact has been short, water-soluble compounds can be washed out, but others are troublesome.

Natural fibre ropes, particularly sisal if not specially treated, swell and stiffen in water, losing up to 15% of their strength. Frozen rope should not be used; it can lose half its strength, though thawing completely restores it.

ROPES IN USE

Special care needs to be taken with rope when working with it, specially if conditions are not ideal and damage from grit, sharp edges or machinery or the like is possible.

Loading Rope

The safe working load of a rope is usually held to be between one sixth and one tenth of the minimum breaking load of the new rope, depending on the application. Whenever it is critical, specifications on the rope should be sought from the manufacturer, but a rough guide to the safe working load can be calculated. Take the number of millimetres in the diameter, square it and call it kilograms. This is roughly the safe working load of sisal or manila rope. Reduce this figure by a third for cotton, by three quarters for coir, increase by a third for polyethylene, increase by a half for polypropylene, and double it for nylon or polyester. Thus it will probably be safe to apply a load of 100 kg to a 10 mm diameter rope if it is made of sisal or manila, 67 kg if cotton, 25 kg if coir, 133 kg if polyethylene, 150 kg if polypropylene or 200 kg if nylon or polyester. Remember that the method of construction of a rope affects its strength, and the strength is not a simple function of the cross-sectional area. Whenever you expect to be applying full loads to a rope, check with the manufacturer the breaking strain and safe working load of the kind and size of rope under the conditions of use.

Any knot in rope will weaken it. Knots with the greatest load applied to very sharp bends are weakest. The strongest knots spread the load gradually over some distance before there is a grip. The comparative strengths of different knots depends not only on the design of the knot but also on the materials, construction and size of the rope, the ambient conditions, the way the knot is tightened and the way the load is applied. While a number of publications list comparative strengths of knots, few specify the exact conditions of testing, so

it is not surprising that the figures and the ranking differ in different reports. In any case, the data would only apply to those conditions and could not be generally applied. As a rule, splices are stronger than knots.

Kinks will develop in rope if it is repeatedly twisted in one direction without throwing the twists out of the end of the rope. Kinks will also form if the rope is led in a slanting direction over an edge. If a kink is pulled through a restricted space such as a pulley, serious damage will result. Kinks are best removed by allowing the full length of the rope to hang free from a height so that the weight of the rope will pull out the kinks gently.

A **dynamic** load, such as a sudden jerk, imposes much more stress on a rope than a steady one and so is more likely to overload or break it. Any rope that has been subjected to a considerable dynamic load should be carefully inspected and discarded if in any doubt.

The stress in a rope taking a load at an angle, as in the slings holding a crate or the footway of a rope bridge, is much greater than the actual load and this must be allowed for (see 549). Likewise if a rope under tension is plucked, considerable stress arises. A rope under tension is also much more readily cut whether by a knife or a rough sharp edge.

A rope of natural fibres will creak and groan before it breaks under a gross overload, but synthetics give little warning other than a slight reduction in diameter. The elasticity of synthetic fibres, specially nylon, turn the rope into a very effective catapult if it breaks—and if it is the fixing, not the rope, that breaks, then it becomes a loaded catapult. Stand well clear of any rope, most particularly if of nylon, that is subject to heavy load. A rope that breaks under tension may well be greatly weakened throughout its length, not just close to the break, and the whole rope should be discarded.

Working Rope

Try to keep a rope for its intended use—for example, do not use a climbing or lashing rope for towing or as a clothes line.

Don't walk on rope, specially if the rope is lying on a sandy or gritty surface. Similarly, don't drag rope over rough, gritty or splintered surfaces. If a rope is liable to chafe on a rough surface, protect it by covering the surface or, for example, wrapping the rope in sacking or inserting it in a split length of plastic hose. Otherwise the outer fibres of the rope will be damaged. Sand or grit grains that penetrate a rope can cause damage inside it where it is hard to see.

If a rope under load passes over a sharp bend, the outer fibres are greatly stressed. If they break, the stress is transferred and the whole rope is weakened. A rope, specially a laid rope, that passes round a metal rod of similar diameter, may lose 30% or more of its strength. Kernmantle ropes lose less than this; indeed, in practice such ropes passing over a karabiner never break at the karabiner, only at one of the knots in the system; of course, a sharper point may cause failure. If you are lifting a load with sharp corners, pad them.

Small pulleys put great strain on a rope and increase the friction of the system. The pulley diameter should be at least five times that of the rope, and the pulley groove should match the rope, supporting at least a third, preferably a half, of its circumference. Kernmantle ropes suffer less stress within the rope and can be used round smaller pulleys without risk of damaging the rope, though friction is still increased.

Avoid excessive friction caused by rope rubbing over objects, specially other ropes. Heat can build up in synthetic ropes sufficient to melt them right through, and surface damage is easily incurred. The surface of a rope under load can be melted by quite a small motion. Synthetic ropes running over a metal rod generate heat in the metal through friction. If the rope is then stopped but held under load in contact with the metal, the rope may melt through; while still in motion, the rope does not have time to heat up before it leaves the metal.

If the end of a rope starts to fray during use, repair it without delay with a whipping or at least a Constrictor Knot or a Back Splice or a stopper knot, or you may finish with a very long length of unravelled rope.

ROPES OUT OF USE

Care of Rope after Use

Dirty ropes, or ropes that have been subjected to chemicals, including sea water, should be washed in fresh water; small patches can be scrubbed. Very dirty synthetic ropes of suitable size can be washed in a washing machine: make a Chained Coil (29) of the rope, use cold or lukewarm water (temperatures above body heat may be dangerous) and a detergent safe for the fibre; most domestic laundry or dishwashing detergents, and those used by most commercial laundries, are unsuitable: pure soap is best. A very muddy rope will probably need close attention with soap and a nail brush. Rinse well. Marine growths are best removed from a rope by thoroughly drying it and then working and agitating it so that the growth is broken up and shaken loose. Do not dry-clean rope or anything containing rope like the luff rope of a sail.

Natural fibre rope should be thoroughly dry before storing or moulds will grow and damage the rope. Do not used forced hot-air drying. Synthetic ropes are not susceptible to moulds but are still best stored dry.

Rope subject to wear in particular parts only, as in a tackle, should be changed end for end occasionally, or otherwise arranged to distribute the wear.

Inspection of Rope

Periodically inspect every working rope, checking the whole length a small portion at a time. If you know that a rope has been subjected to an excessive load, specially if it was a dynamic load, it may need to be discarded even if there is no obvious damage. If there are cuts or deep abrasions in the middle

of a rope, cut out the damaged portion; the rest of the rope can have normal use only if you know the cause of the damage and are certain there is none elsewhere.

Laid Ropes: look for signs of local abrasion, cuts, nicks and contusions; some fluffing of the outer yarns is normal. Look for any reduction in diameter or elongation of the lay, indicating overloading. Look for discolouration or abnormal fibres that indicate corrosion. Discolouration, bleaching or frequent breakage of the fibres of natural fibre ropes indicate excessive weathering. Smaller sizes of rope have most of their fibres reach the surface at some time and should be discarded if many damaged fibres can be seen.

Open up the lay, taking care not to form kinks. Look for flattened fibres, powdered fibre or a broken core if there is one. Discard any doubtful rope, or use it only for unimportant, light loads or for practice knotting.

Core and Sheath Ropes: in most core and sheath ropes, not including dynamic kernmantle rope, the core provides most of the strength, the sheath providing protection. In such a rope up to half the fibres in the sheath can be broken and the rope still remains useable. Damage to the core is very unlikely without obvious damage to the sheath, but it is still worth while feeling along the whole length of the rope periodically, preferably with the rope under tension. The core will feel clearly thinner if any significant proportion of the core fibres are broken. Discard any doubtful ropes.

It is worth while to inspect at least life support ropes every time you uncoil them before use and every time you coil them after use. Run the whole length of the rope through your hands and feel and look at all of it.

Storage of Rope

Rope should be stored in a dry unheated room with a good air circulation, preferably not on the floor. Rope should not be stored tightly packed. Do not store where the rope can be walked on or damaged by falling objects.

Do not store in tangled heaps which may allow kinks to develop. Remove all knots from the rope, particularly any knots with sharp bends. All rope should be stored in neat coils as discussed earlier. If possible each coil should hang separately, in any case not in large stacks where the lower coils are compressed by the weight above. Shelves or boxes used to store rope should be slatted to allow ventilation; bags should have an open weave. Provided it is dry, synthetic ropes can be stored in more confined circumstances than natural fibre ropes.

A rope store should be kept free of vermin. Rats, mice, possums and other vermin sometimes make nests in rope. Even if they don't gnaw the rope, their urine and faeces may corrode it.

The air in the store should be free of fumes from solvents or acids; paints or storage batteries are best kept elsewhere.

Chapter 4
KNOTS

Knots are amongst mankind's earliest inventions, probably more or less contemporaneous with stone tools and long preceding the use of fire, agriculture or domestic animals. Early uses were in binding clothing, erecting habitations, making nets, snares and lines for hunting and fishing and, later, binding handles to stone tools. Decorative work for belts and bangles, necklaces and head straps and the braiding of hair were also very early uses.

We know from the art they have left us that people had considerable capacity for abstract thought and for recognising patterns at least 30 000 years ago. These are the very qualities needed for inventing new knots. With the many practical and decorative uses for knots ever since, we can say that if we could look at all peoples all over the world and at all times we would find a very large number of knots, quite likely all the knots now found in knotting books, perhaps excepting only the more complex sennits and other decorative work. There are quite likely to be no really new simple knots under the sun; they have already been tied somewhere. Indeed, some mathematical philosophers maintain that all possible knots already exist as Platonic ideals, like all possible numbers. They merely await recording.

Certainly, the ancient Phoenecians, Chinese, Greeks, Peruvians, Romans and Mayas, and all the other great civilisations used ropes or threads and knots in agriculture, animal husbandry, engineering constructions, and weaving. Cords and knots were also used in records and messages (quipus), in magic, in games (cat's cradles) and in many other ways. Modern traditional hunter-gatherers, peasants and sailors carry on many of their practices.

More recently builders, stockmen, stevedores, miners, weavers, riggers, bookbinders, firemen, sailors, farmers, steeplejacks, fishers, craftspersons, transport workers, bridge builders, rescue workers and pioneers of all sorts have used ropes and cordage and have tied knots in them. Until the last couple of centuries and the invention of all sorts of mechanical fastenings and gadgets, everyone, not just the specialists, would have needed quite a few knots just for everyday living. We now know that there are many satisfactory knots for almost any one purpose, and there seems no particular reason for everyone all over the world and in every age hitting on the same knot. Therefore there must have been a very large number of knots in everyday use somewhere or other, a larger number of knots known to specialists, and probably a much larger number of knots that had been tied but never used to any extent.

Knotting Books and Records

Most of the old trades and crafts really needed only a few knots, but different knots were developed in different trades and in different countries, even for very similar functions. There is little definite information on really early knots. A very few have survived to be discovered by archaeologists, a very few are recorded, usually rather vaguely, in paintings or carvings. However, the earliest writers of books were not interested in the details of mere trade so that the earliest written record of knots, on knots used by physicians, dates only from the fourth century AD (though it seems to quote a work a couple of centuries earlier). Thus a few very old knots have become known, some still familiar to most modern western knotters.

The recording of knots only really started in the great days of sail in the last century. Once long voyages became possible, sailors experienced long periods of idleness, particularly perhaps on the overmanned whaling ships, and, having little else to do and plenty of raw material, they could experiment in both useful and decorative knots and compare their work with many others. Most of the sailors, of course, were illiterate but some of their officers were more educated and, becoming interested in the work of their men, wrote the first knotting books of the kind we can still recognise. Knots used in other trades or crafts have been little recorded in specialist knotting books until the twentieth century, and even then it seems likely that many knots and applications are still unrecorded. Most of these books are European or American in origin, though a few Chinese and Japanese books exist.

There has been very little comprehensive study of the knots tied in ancient times, in traditional societies or even in some of the less notable trades in modern western societies, nor has there been much comparative study of the knots used in different countries, ethnic groups or even occupational groups. I believe that this is at least in part because there is no agreed way of classifying or naming knots so that deep study is inhibited by a lack of words to describe the findings clearly, precisely and unambiguously.

Maybe a first step along the way to developing such words or such studies is indicated by my attempts in this book to arrange the knots in a more or less logical fashion based on the fundamental structure of the knot.

Knots are commonly associated with sailing, boating and shipping; knotting books, no matter what knots they discuss, are often found in nautical sections of libraries and bookshops. But nautical knots were not historically the first in use, and are not now the majority nor the most essential to safety, and nautical users are not now the major innovators of knots.

More recently, mechanical devices have taken over from many of the knots, except in the sports such as yachting, angling, mountaineering and caving which continue to use knots as well as machinery. With the introduction of new synthetic fibres in ropes and lines, many of the old tried and trusted knots have been found wanting and have had to be modified or replaced by other knots, some of which were not to be found in knotting books. While I doubt if there are any truly new simple knots, it is certainly possible to be the first to publish a knot and comparatively easy to be the first to publish a knot in readily available knotting literature.

This book contains some of the old traditional (in Anglo-American usage) knots as well as some of these "new", or more likely rediscovered, ones. I have not told where I learnt the knots or from whom, since it seems to me that that information is either trivial or misleading. Even where my source of information devised the knot afresh and unaided, I doubt if it was really new.

SOME MORE DEFINITIONS

Names of Knots

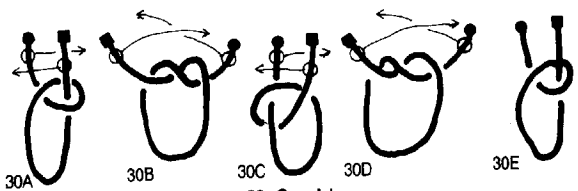
The term **Knot** applies to all interweavings of ropes and rope-like things, but it rarely occurs as part of the name of the knot unless (i) it is tied in one end of a single rope, as a stopper knot, a lanyard knot, a loop or a noose (ii) or it uses both ends of a rope as a binding knot (iii) or it is typically tied in small cords, twine etc (iv) or, of course, it was named by someone unaware of traditional usage. A **Bend** connects two ropes, typically in line, end to end. A **Hitch** connects a rope to another object, such as a spar or a ring bolt, or the standing part of another rope. However, there are exceptions to these rules. The naming of knots is chaotic.

There is no universally recognised system of naming knots. Thus if you look at the names of knots used in different trades or crafts or in different regions, you will find that several names are applied to the one knot, and that some names are applied to several knots. For example, what I call the Fishermans Knot (103) is also known, somewhere or other, as the Anglers Knot, English Knot, Englishmans Knot or Bend, Halibut Knot, Leader Knot, True Lovers Knot or Bend (a name I give to 118 and others give to my 119), Water Knot or Bend (a name I give to 140 and others give to several other knots) or Watermans Knot. Some knots do not seem to have distinct names, either in the common knotting books or amongst many users of the knot, even if they have been in use for very long periods. Knowledge of newly developed knots in particular applications may spread rapidly and widely and the knots may acquire many localised names, as is shown in the fishing, climbing and caving literature. These confusions in the naming of knots raise few problems with localised groups of people in the one trade or craft, who are mostly very comfortable with their own traditional names, but they do make difficulties for anyone interested in knots in general.

In this book, I have made no attempt to discover the name that is either the earliest in use or the most widely known and there are far too many synonyms to include them all. I have simply used the first name I came across, or if that is duplicated, some other name, or I have invented one. My policy

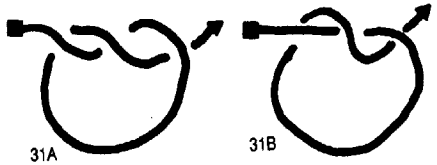
has been to give every knot in the book a unique name. Some of my invented names get a bit long because I can't find a short one that is descriptive of the structure, the appearance or the function of the knot. To my mind, knot names should avoid geographical or personal names, which rarely reflect the true history of the knot, or whimsical names which reflect no more than the mind-set of the person who gives the name and usually thinks, with very little real evidence, that he has invented the knot.

Some More Knotting Terms



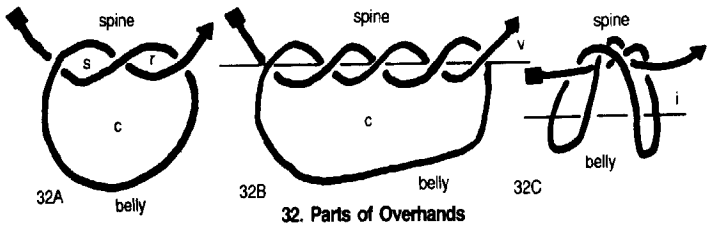
30. Capsizing

Many knot configurations change form under stress. A knot is said to be **capsized** or **upset** if the ends are pulled in directions different from those inherent in the design of the knot, or are given a jerk instead of even tightening. Thus a Half Hitch (30A, 30C) can be capsized into an Overhand Knot (30B, 30D) by pulling the ends in the directions shown, and Overhand Knots (30B, 30D) are capsized into Half Hitches (30C, 30E). Note that the handedness of all these knots is the same. A properly tied Overhand Knot has the two ends **twisted** together (31A), not one **wrapped** round the other (31B), which is a similar capsizing. Care must be taken that the correct form of the knot is tied; the capsized is usually less secure, sometimes spilling completely. Thus a Reef Knot (165A), which is reasonably secure, capsizes to a Bucket Hitch (165B), which slips; indeed, this is one of the ways to untie the knot. It is, however, sometimes convenient to use capsizing to tie a wanted knot. Thus half hitches can be transferred from one rope to another, as 30A to 30C, when tying a Firemans Chair Knot (99) or Sheepshank (364); or overhands can be capsized to half hitches in tying a Mohair Knot (133) or a Cast Bowline (405); other capsizes are used in tying a Climbers Bowline (409) or a Capsized Carrick Bend (477).



31. Twisting and Wrapping

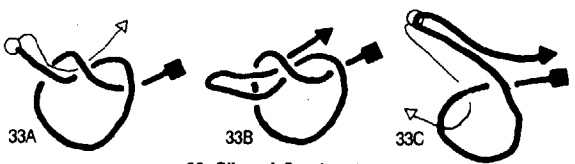
Overhand Knots form part of the structure of many others, as we see later, so it is useful to name the parts. The twisted part of an Overhand Knot is called the **spine** and the turn the **belly** (32A); the spaces within the spine are called the **standing space** or the **running space**, depending on its nearness to the standing part or the running end, and the main interior of the knot is called the **central space**; these are abbreviated **s**, **r**, and **c** in 32A. A Double Overhand Knot (62) likewise has a **spine**, a **belly** and a **central space** as before (32B); a line through the spine can be called the **vertebral space**, abbreviated **v** in 32B. If the Double Overhand Knot is made in the Grapevine form (62F)



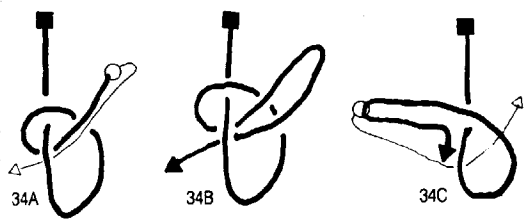
32. Parts of Overhands

we can still distinguish a **spine** and a **belly** (32C), and a line through the twists of the rope forming the belly of 32B can be called the **interior space**, abbreviated **i** in 32C. The same terms can be applied to other multiple overhand knots.

A knot is **slipped** or made **slippery** if the running end is passed parallel with its standing part past the last grip (sometimes the last two grips) of the knot. Thus 33B shows a Slipped, Slippery or Slip Overhand Knot, and 34B a Slipped, Slippery or Slip Half Hitch. It is often more convenient to make a slipped knot by making the last grip (sometimes the last two grips) of the knot with a bight (33C, 34C) rather than directly as in 33A, 34B.

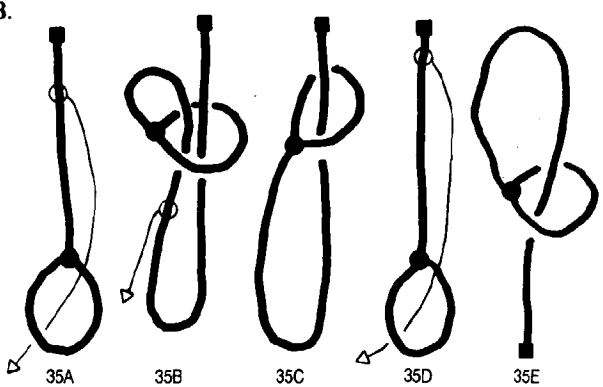


33. Slipped Overhand

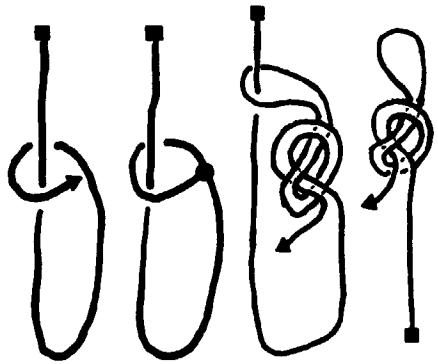


34. Slipped Half Hitch

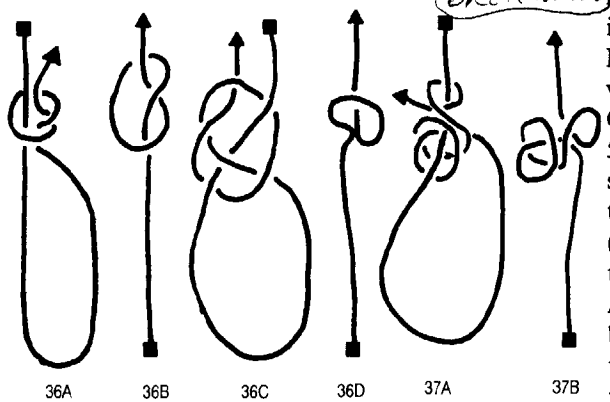
Some knots are made to slide along a rope. Most commonly, these are sliding loops. Three kinds of sliding loop may be distinguished. A **Running Loop** is an ordinary independent loop (35A) around its standing part, made by **reeving** (passing through an eye or other hole) a bight through the independent loop (35A–35C), by threading the standing end through the independent loop (35D, 35E) or tying the knot so that



35. Running Loop



35. Running Loop



36. Noose 37. Adjustable Loop

it encloses its own standing part (35F, 35G). A Running Overhand Loop (35H) is an example; if the standing part is pulled out of the loop, a good independent loop, in this case the Overhand Loop (35I; 134) remains. A **Noose** is made to draw tight round an object. When subjected to a load, the knot itself tightens so that further sliding, particularly loosening, becomes difficult; the more extreme instances are known as **Jam Knots**. If the standing part is pulled out, a firm knot may remain, as in the Overhand Noose (36A; 77) which leaves an Overhand Knot (36B; 58), or the rope may spill completely, as in the Crabbers Eye (36C; 88) which spills to nothing (36D). An **Adjustable Loop** can be adjusted to size, then take a load between the loop and the standing part. When the load is removed, the loop may be adjusted by pushing the knot along the standing part, and then a load may again be taken on the loop; if the standing part is pulled right out, a knot may or may not remain—a Rolling Hitch (37A; 457) spills completely (37B).

Kinds of Knots

Some types of knots have been given special names, in addition to those already described.

Binding Knots either constrict a single object (for example, the neck of a bag, or a parcel); or hold together several objects (for example, a bundle of poles). Examples are the Reef Knot (165) and the Constrictor Knot (150).

Crossing Knots hold together bights of two ropes or one bight against another object, more or less at right angles, for instance the crossing of lines on a parcel, fences or clothes lines. Both ends are available for further use, indeed often must be used to maintain the integrity of the knot. Examples are the Crossing Knot (318) and the Clove Hitch (372).

Hitches may be further divided into **Loose Hitches**, where the knot is on its own standing part (e.g. the Rolling Hitch, 457), **Snug Hitches** where the running end is tucked under the turns round the object (e.g., Timber Hitch, 300; Millers Hitch, 463), and **Ring Hitches** which attach to a closed ring, of diameter significantly less than that of the rope (e.g., the Running Eye, 380).

Stopper Knots are tied in the running end to stop the rope passing through any aperture, or provide a grip on the end of the rope; they are sometimes used as a temporary means of stopping the rope unravelling. Examples are the Overhand Knot (58) and the Manrope Knot (239).

Many arrangements of rope, cord etc are quite decorative; whether serving some useful purpose or not, the general term for such arrangements is **Fancy Work**. Special kinds include:

Button Knots have the two ends emerging together from the centre of the knot, which is usually symmetrical. An example is the Chinese Button Knot (475).

A Sennit, sometimes also spelt **Sinnet**, is plaited or braided cordage that may be flat (e.g., the French Sennit, 499), round (e.g., the Round Sennit, 508), square (e.g., the Square Sennit, 512) and so on. Usually sennits are of indefinite length and often some special knot is needed for a start or finish. Instead of using separate cords, the strands of laid (or plaited or braided) rope may be used; such sennits merge with **Strand Knots** (Chapter 12), more discrete interweavings of the strands of a rope, and with **Splices** (Chapter 13), interweavings of the strands or other parts of a rope to unite two ropes or parts of a rope.

A Lanyard is a short cord for holding something such as a knife or whistle and often looped round the neck or shoulder. Some decorative lanyards are simple sennits but others consist of single cords with decorative **Lanyard Knots** (e.g., the Conjoint Overhand Knot, 121) or two parallel cords joined at intervals with decorative **Two-strand Lanyard Knots** (e.g., the Japanese Lanyard Knot, 114); the ends enter and leave the knot at opposite ends so that it is easy to make the knots in series.

A Turk's-Head or **Turkshead** is a decorative cylindrical weaving of cordage, typically resembling a turban, usually round something such as a thicker rope but sometimes free-standing (such as a serviette ring); examples are in Chapter 20. Typically turksheads are made with a single cord, and the ends are concealed.

A Coxcomb is a decorative covering for a core, which may be a rail, a steering wheel or another rope, for an indefinite length. Typically there is a single raised portion of the knot running along its length and suggesting the name (e.g., the Simple Coxcomb, 377A); this raised portion may be purely decorative or may be used to aid the grip, as well as holding the binding together if there is a single break in the cord.

STRENGTH AND SECURITY OF KNOTS

We need to distinguish between the strength and security of a knot, two properties essentially independent of each other.

The **strength** of a knot is the force required to break a rope containing the knot, commonly expressed as a percentage of the strength of the unknotted rope. But the strength of a knot is not a constant, it depends on a number of things in addition to the structure of the knot. The chemical composition of the fibres used to make the rope, the structure and size of the cordage can make major differences to the measured strength of the knot. The way of applying the breaking tension, gradually or as a jerk, may make a major difference. Environmental conditions such as temperature and humidity can also affect strength. These factors influence not only the absolute figure for the strength of a knot but also the relative order of strength of different knots. So published data on the strength of knots apply only to the conditions of the test, not necessarily to other conditions. If it is important to know the strength of a knot in a particular application, it is necessary to test under the conditions of the application. That is why, for example, climbing ropes intended to hold a falling climber are tested to see how many times they can hold a 80 kg weight falling 5 m before failure; a minimum of five falls is required. The safe working load is, of course, only a fraction of the breaking load.

The **security** of a knot is related to the force required to make the knot slip or capsize to an unwanted form. It is influenced by how the knot has been drawn tight as well as the nature of the rope and how the force is applied. It is not often expressed in figures, usually just as one knot being more or less secure than another.

There seems to be no theory that will reliably predict the strength or security of a knot from a knowledge of the structure of the knot and the conditions of the test.

Chapter 5
TYING KNOTS

Learning how to tie knots out of a book is never as satisfactory as learning from an experienced teacher, but sometimes that is all you can do. There are tricks of the trade to be learnt in both tying and untying knots, and also in teaching the tying of knots. I hope that what I say here may help both learners and teachers.

LEARNING TO TIE KNOTS

If you do much knotting, you will need a few tools. A sharp knife is essential; if you do much with very small cordage, scissors are useful, while nail clippers are useful to trim the ends of fishing lines after knotting. Pliers help to pull through turns in tightly tied knots: round-nosed or other pointed design are best, and for smaller sizes of cordage, artery forceps are valuable. A spike such as a marlinespike is useful to open up tight turns, particularly in splicing and in making strand knots. If you expect to make many splices in double braid rope the special fids for the purpose are almost essential (see Chapter 13).

It is best to practice tying knots using rope not too different in size and construction from the ropes you will actually be using. If you are going to be knotting heavy hawsers, trying to learn your knots using 2 mm diameter cord will give you misleading information; if your main interest is in fishing line, don't practice using 20 mm diameter natural-fibre rope. For general use it is probably best to practice with rope of two sizes, one 10–12 mm diameter and 3 m long, the other 2–3 mm diameter and 1–2 m long. You may need at least two ropes of each size. Of course, for fancy work you will need longer cords of the appropriate diameter. The ropes should have secure whippings and it may help if the ends are of different colours and maybe the ropes themselves can be of different colours. To practice strand knots and splicing in stranded rope you need to have each strand securely whipped, and you need a very short but secure whipping at the point to which you would ordinarily unlay the rope.

Tying knots is best learnt from a teacher familiar with the knots you want, but after some practice in a variety of knots you should be able to pick up quite a bit from books. Sometimes books give instructions in words sufficiently detailed and unambiguous to follow, but mostly you will need to follow diagrams, which should really be opened up to show the internal details. If the knot is fairly complex, it is often a help to highlight in different colours different sections of the knot in the diagram.

Note carefully on the diagram which is the running end, which the standing part. Take a rope and, starting from the standing part section of the knot, carefully follow all tucks etc with the running end. For bends, put one rope in the shape of that end in the finished knot and use the other rope to follow through, carefully matching each tuck. Knots must be tightened firmly before putting them into use. I call this method of tying a knot from a diagram of the finished thing the **direct** method; many knots can be tied by other, sometimes much more convenient, methods; if your book shows these methods, then fine, but if not they can take quite a bit of trouble to discover (see Chapter 22). In this book I assume the reader ties knots right-handed; left-handed people will have to adapt my instructions for themselves. Left-handers will sometimes

find it worthwhile to tie knots of opposite handedness to the ones shown in this book; hold the diagram up to a mirror to see what it should look like. Note that if they are using right-handed laid rope the handedness of the knot is sometimes important and they will need to observe that, whatever their own handedness.

Knots tied in a rope under tension, as when making fast a loaded rope, must obviously be carefully pulled tight in each part as it is made. But when tying a knot in a rope before it is loaded, it is generally best to form the knot carefully, then hold the completed knot in one hand and pull each end in turn, firmly and smoothly, without jerks, until the knot is quite firm; complex knots may need to have separate elements worked tight in turn. The knot should be oriented so that each part travels the shortest practical distance through the knot; this makes sure there will be no internal jerk on tightening. You should be quite familiar with what the finished knot should look like, not just what the book shows and you should check that your knot has everything in the right place before tightening finally. If your rope is very stiff, you may need to pull the knot as tight as you possibly can, but with softer ropes it is usually possible to get the knot firm enough to prevent slippage but not so tight that it will jam and be very hard to untie. Of course, in general you will not want to untie fishing line so it can be pulled really tight. Most of the diagrams in this book show the knot only in a loose form, before tightening; a drawing of a properly tight knot is often more confusing than not, unless several views are given.

Fishing line, specially nylon monofilament, needs some lubrication to help draw up knots. Saliva is best, plain water usually adequate. Many fishing knots have a lot of turns, the more slippery the line, the more turns. Monofilament nylon needs at least five turns in these knots, some people recommending as many as ten. To aid clarity, in this book I have not always shown all the turns that are desirable.

All knots are liable to slip a trifle as they take up the load, more for the synthetics than for natural fibres. Polyethylene slips most, polypropylene least for the same construction; stiff ropes slip more than flexible ones. The **tail**, the length of rope between the knot and each running end, should allow for this slippage. A tail of 3–5 times the diameter of the rope may suffice for natural fibre rope, but synthetic ropes need much more, up to about 20 times the rope diameter for a very stiff rope. A good rule of thumb is that the tail should be long enough to tie an Overhand Knot in it. A few knots (such as the Short End Bend, 406) are designed for tying with very short tails; they should not be tied in stiff synthetic ropes and should not be heavily loaded. Fishing knots are usually trimmed very short; the many turns are meant to take up all the slippage before the end is reached; in any case, if one end pulls out, there are usually plenty of turns left.

Once you have learnt to tie a knot, it is a good idea to see if you can tie it in the dark, or behind your back, or left-handed, or one-handed, or all four!

When you can do all these, you know how to tie the knot. Practice makes perfect.

TEACHING KNOT-TYING

Undertaken responsibly, teaching others how to tie knots is a good way to ensure you can tie them properly yourself. The only better way is long experience of using the knots in a variety of applications.

Work out what knots you wish to teach; find out what knots your pupils know already; and then design a logical order starting where they are and finishing where you want them to be. Thus if they know the Overhand Noose (77)—they probably do, but maybe not by name—you can teach them the Bowline by the Climbers method (409); you might then wish to teach other ways of making a Bowline, depending on the applications wanted. The way knots are arranged in this book should help you design courses in this way.

The rope you use to demonstrate knots should be the same in handling properties, though maybe of larger diameter, as the rope your pupils will be using. This in turn should be of similar size to what they will be using in practice.

It is often difficult for pupils to follow ways of tying knots demonstrated by someone standing in front of them. If you have large numbers of pupils, turn your back and tie the knots over your head (in some places, kneel down), so that your pupils merely make their hands follow yours as they see them, without reversal. If you have only a few pupils, sit beside one and tie the knot. If anyone still has difficulty, stand behind them, put your arms around them and tie the knot just above or just below their hands as they follow yours. In all cases, show the knot once or twice and then get them to tie the knot in time with you as you work slowly. Don't forget to work the knot tight each time; don't let anyone develop bad habits of leaving the knot loose.

You, the teacher, will thus have to be able to tie the knot without seeing what you are doing, and you may well have to be able to tie the knot both left-handed and right-handed. Sometimes left-handers can follow how to tie a knot from a right-hander who is facing them.

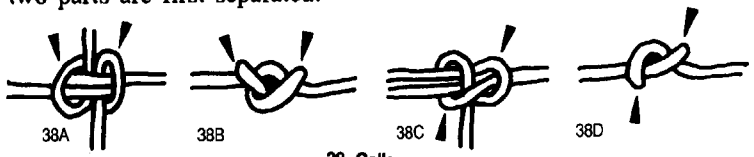
Your pupils should have suitable illustrations of the knots, perhaps in several stages of construction, to take home with them. Satisfactory illustrations can often be made by photocopying the knot, though some photocopiers (and some owners of photocopiers) are more satisfactory than others. And your pupils should have suitable rope at home or carried with them, so that they can practise whenever they have a few moments to spare.

UNTYING KNOTS

Knots subjected to heavy loading can jam very tight, but except for most of the fishing knots you will probably want to untie them. Many problems can be

avoided by tying slip knots (33, 34), which are nearly as strong as the original knot, though they may not withstand a give and take motion.

Knots in two parts, such as the Fishermans Knot (103) are easier to untie if the two parts are first separated.



38. Collars

When some knots, for example the Riggers Bend (38A; 128) or the Sheetbend (38C; 395) are loaded, loops or **collars** are pushed up (arrowed in 38B, 38D). A first step in untying is to push the collars down, in the direction of the arrows. This loosens the knot a little. A marlinespike can be very useful in loosening jammed knots.

Some knots can be untied by capsizing them into a sliding knot, which can then be slid off the end if it is nor too bulky. For example, the Reef Knot (165A) capsizes to the Bucket Hitch (165B).

If you try to push an end into a knot to loosen it, it helps to twist the end a little (in the direction of tightening the lay if any). This stiffens the rope and diminishes the diameter a trifle for some ropes.

Chapter 6

ARRANGEMENT OF KNOTS

HOW KNOTS ARE USUALLY ARRANGED

The principal aspect of my Fresh Approach to Knotting lies in the arrangement of knots in the book. A glance over other reasonably comprehensive knotting books shows several schemes, though they are not usually described or discussed. Chief arrangements seen were:

▸ Random Order: apparently the knots are arranged in the order in which the author came across them. This makes it an easy book to prepare but it can be hard to use. For example, one such book separtates by several chapters a left-handed and a right-handed Half Hitch.

▸ Alphabetical Order: the knots are arranged in alphabetical order of the author's preferred name. This saves preparation of an index but is hard to use by anyone from a different knotting culture than the author, using different knot names.

▸ Appearance of Knots: the knots are arranged more or less systematically by their superficial appearance. This can lead to odd associations; for example, one such book places the Figure Eight Knot (279) and the Carrick Bend (472) in close proximity, despite considerable differences in ways of tying, function and real basic structure.

▸ Derivation of Knots: the knots are arranged in a distinctive linear order, deriving each knot from the preceding one by some trick of tying, which may or may not lead to an efficient way, or by making or deleting a particular tuck. This makes for easy learning for a small number of knots but if the number of knots is at all large, there are too many possible branches in the route and confusion is likely to result.

▸ Function: by far the commonest arrangement is by function, placing for example all bends together, or all single loops. This makes it easy to find a suitable knot for a given purpose. But it separates closely related knots, such as the Bowline (400) and the Sheetbend (395), diminishing ease of learning. And the more generally useful knots need to appear in several categories: for example, one such book lists the Clove Hitch (372) in at least seven Chapters, all perfectly valid but, without a massive amount of duplication or cross-referencing, it is troublesome to locate all the uses of a knot.

▸ Classification: several systems of knot classification, some computerised, have been proposeed for making a catalogue of knots. They have been based on such things as the number and nature of crossing points, or the number and nature of such other elements as turns, twists and reversals of direction. All the schemes that I have seen have been tentative, none fully developed.

It seems to me that none of these systems of arranging knots, whether in ordinary knotting books or in the classification schemes, are fully satisfying if they deal with large numbers (hundreds or more) of knots. They tend to separate obviously related knots and lump together obviously unrelated ones; they are not readily adaptable to identifying an unknown knot; they are too much influenced by special considerations such as special applications or special methods of tying.

ARRANGEMENT IN THIS BOOK

In this book, I have attempted to arrange ~~books~~ knots by their structure, by what gives them their strength and security, by where the nips in the cordage lie. This seems to me to make for easy learning of a large number of knots, because the knots are no longer isolated exercises in remembered dexterity but a systematic following of the natural logic of the knots. It emphasises relationships and the different applications of each basic structure. It encourages thought about knots, and leads to adaptations and versatility in using knots. And if you come across a knot new to you, it is relatively easy to discover if the knot is listed in the book.

Of course, I also tell you how to tie the knot and what it is used for, and how to find a knot suitable for your purposes.

An outline of my system of classifying knots is given in the Plan of This Book, to be found on pages *xi–xv*, and there are further comments at the head of some chapters or sections. Here I want to discuss some of the problems met in attempting this classification.

My primary division of knots has been into those with distributed nip and those with concentrated nip.

In the first group, there is contact over relatively long lengths between two ropes or parts of one rope, exerting a pressure that is either more or less even along the whole length, or gradually diminishes from a maximum where the rope enters the knot to a minimum either in the middle or at the other end of the knot. This contact may be in twists, most obvious in and most common in the Overhand Knot and its derivatives (Chapters 8–10), or in encirclements, often with multiple turns (Chapter 11) or in the interior of the knot, as in Strand Knots (Chapter 12) and Splices (Chapter 13).

By contrast, the second group has all or most of the nip concentrated at a few discrete points, often where a standing part presses down on its own running end, entrapping it. The commonest members of this group are the common Hitches (Chapters 16 and 18) and the Sheetbends and Bowlines (Chapter 17), but knots with many points of contact, mostly fancy work such as Turksheads (Chapter 20) and Sennits (Chapter 21), also come in this group.

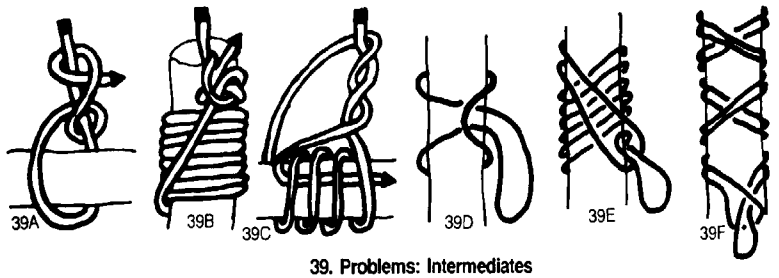
However, many knots seem to include both kinds of nip, and it is often difficult to decide just where the major nip occurs. Other knots seem to contain something intermediate between the two groups. With yet other knots, it seems that quite minor working of the parts of the knot under load or by simple manipulation; converts the nip from one type to the other. Maybe, if I studied more knots, more categories would become evident and a proper allocation become easier.

I call attention to some of these problems below, in justification of my allocations. But I must confess that in allocating some knots to particular places in my classification, I have sometimes made arbitrary decisions and, probably, sometimes been inconsistent. We really do need to gain a better understanding of the functionally important elements in the structure of a knot.

Problems: Intermediates.

Two rather similar knots are 39B (Lifting Hitch, 210A) and 39E (Cross Prussik Hitch, 330), but I have classified them as with a Distributed Nip and a Concentrated Nip respectively. Actually, I had not placed them together for comparison until long after I had allocated their places.

Now, 39B could be considered a higher member of a family beginning with 39A (Two Half Hitches, 337), merely adding a lot of turns. But if looked at more closely, the many turns do almost all the holding in 39B. The two Half Hitches firstly prevent the turns from unwinding and hold them in place,



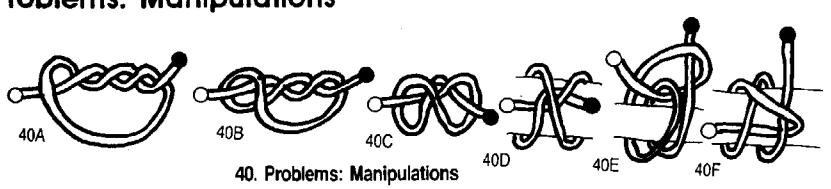
39. Problems: Intermediates

and secondly allow the standing part to change direction from the lift to the turns without allowing slippage. Several other methods have been used to serve the same functions, exemplified in this book by 210B and 211, and in principle the functions could be served by a bit of sticky tape to hold the end in place and a nail or peg to change the direction. Consequently, I decided that the essential nip in 39B was distributed in the turns. A more complex member of this family is 39C (Arbor Knot, 356), which clearly has concentrated nip where the turns of the standing part entrap the running end.

On the other hand, in 39E (Cross Prussik Hitch, 330), the bight of the sling cannot be substituted by a peg and a bit of sticky tape, because the knot is intended to slack off so that it can be moved along. So I have kept 39E in the Concentrated nip section, together with the first member of its family, 39D (Bale Sling Hitch, 328) and the more complex analogue, 39F (Diagonal Sling Hitch, 331).

There seems to me now to be only an uncertain differentiation between 39B and 39E, but some justification can be found and I have left them as first allocated.

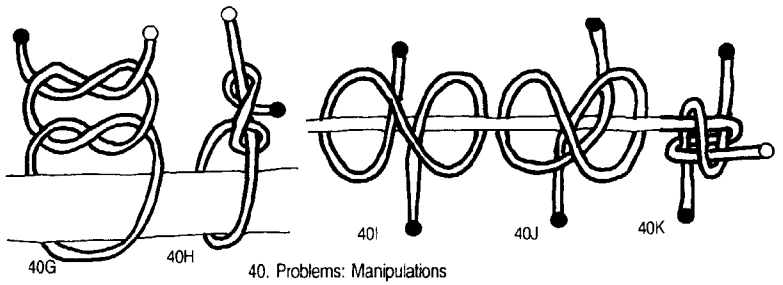
Problems: Manipulations



40. Problems: Manipulations

40A (Double Overhand Knot, Open Form, 62A) has clearly a distributed nip. If one folds it up through 40B to 40C (Double Overhand Knot, Grapevine Form, 62F), there is still a distributed nip, which still remains if a core is inserted and 40D (Strangle Knot, 155) is formed. Yet it needs little manipulation, only a pull on the marked end and sorting out a riding turn, to get 40E (the basic knot of the Fishermans Bend, 348A), which clearly has a concentrated nip, as has 40F (gaff Topsail Halyard Bend, 350), which merely has the Half Hitch of 40E straightened out along the core.

40G (Granny Knot, 161) has clearly a distributed nip, while 40H (Two Half Hitches, 337) has equally clearly a concentrated nip. Yet the first is



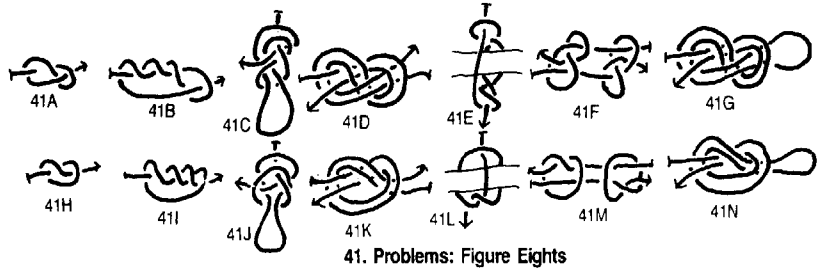
40. Problems: Manipulations

readily converted to the second by capsizing it by pulling on the end marked with the open circle.

40I (Clove Hitch, 372) has clearly a concentrated nip, while 40J (Constrictor Knot, 150), which is basically an Overhand Knot (58) with its belly twisted over its spine, has clearly a distributed nip. But it only needs a simple tuck to convert 40I to 40J. At first thought, a simple tuck in a Hitch should not alter the basic character of the knot, but it clearly does. If 40J is tied over another cord and its ends pulled to capsize it, we have 40K (Reciprocal Crossing Knot, 324), which I have classified as having concentrated nip principally because all the crossings are at right angles, not common in distributed nip knots.

So it takes little manipulation to change the classification of a knot. Sometimes this kind of change takes place when a knot is tightened or subjected to a load. It is interesting to note that manipulations to develop one knot from another may or may not retain the last knot in the same category as the first. That is, the method of tying a knot is not necessarily a good guide to its structure.

Problems: Figure Eight Knots



41. Problems: Figure Eights

Looking at a Figure Eight Knot (41A, 279) before tightening, it appears to have a concentrated nip at the crossing points. This is perhaps not quite so unequivocal when the knot is tightened. Certainly the higher members of the family, such as 41B (Figure Nine Knot, 280), have obvious twists, which should place them as distributed nip knots. There are also many parallels between Figure Eight Knots and Overhand Knots. A few of these are shown

in 41: 41A (Figure Eight Knot, 279) and 41H (Overhand Knot, 58); 41B (Figure Nine Knot, 280) and 41I (Double Overhand Knot, 62); 41C (Rover Knot, 288) and 41J (Anglers Loop, 71); 41D (Flemish Bend, 313) and 41K (Ring Knot, 132); 41E (Stevedores Hitch, 298) and 41L (Lever Hitch, 91); 41F (Fishermans Eight Knot, 303) and 41M (Fishermans Knot, 103); 41G (Figure Eight Loop, 309) and 41N (Overhand Loop, 134). Consequently, I have placed all the Figure Eight knots in the distributed nip series.

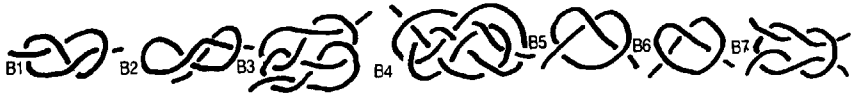
Conclusions

A large number of knots can be accommodated in the sections listed in this book, certainly very many more than I have done. But I don't claim that all simple knots could be. With more knots to consider, more divisions at all levels would probably be needed. After all, there are many thousands of simple knots that can be constructed, to say nothing of the many more thousands of more complex knots such as the sennits and the like.

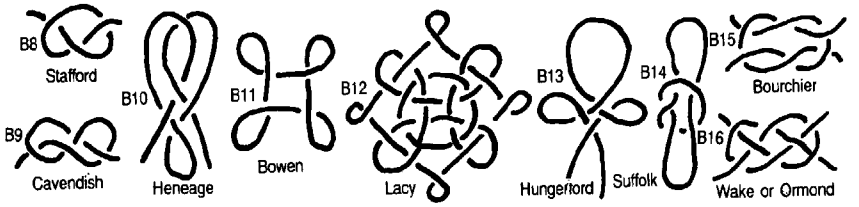
Further study of the structure of knots will help advance knowledge of how knots work, and assist development of modifications of knots for particular applications or for use with the new kinds of rope that are being continually developed.

HERALDIC KNOTS

Knots have been used in heraldry to a minor extent since its beginnings. Heraldic artists have some individual licence, so that several knots or arrangements of rope may appear for supposedly the same object.

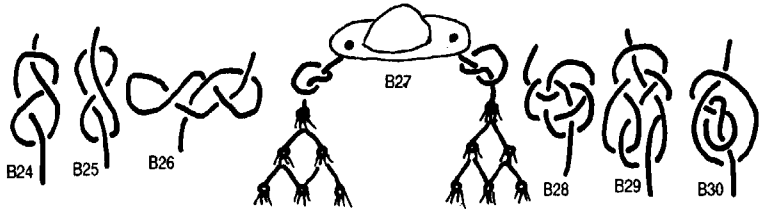


Lacs d'amour (usually translated as a Lovers Knot) occur as charges on quite a number of European shields; but the form varies, as shown here.

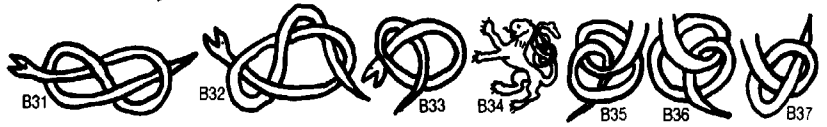


Some British badges, originally used only on banners or the clothing of retainers etc, are now increasingly shown as charges on shields of people or organisations with some connection with the original bearer of the badge.

Knots are also tied on objects, such as "stringed bugle-horns", wreaths, headbands etc. The exact nature of the knot is often obscure.



Some Roman Catholiuc and other clergy use ecclesiastical hats with knotted tassels, instead of helmets or crests above the shield.



Serpents are sometimes shown "nowed" or knotted; the tails of animals, such as the thin tails of lions, or the thicker ones of dragons, wyverns etc, may also be nowed.

PART TWO

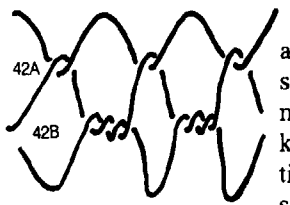
KNOTS WITH DISTRIBUTED NIP

In these knots, the nip is distributed more or less evenly throughout much of the knot. The portions of the knot supplying the grip are, in many of these knots, more or less parallel, either in twists or in such knots as strand knots or splices. Overhand Knots and their derivatives, in which the nip is due to twists, were probably the first knots ever tied by people, so it is not surprising that they have grown into a very large family.

Chapter 7
SIMPLE TWISTS

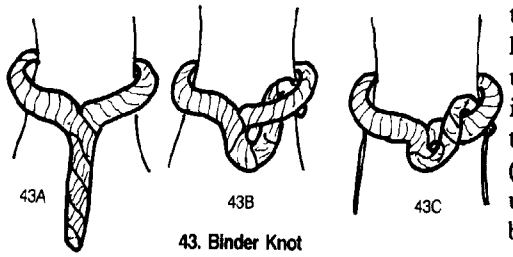
This Chapter deals with the simple twists, with a constant or a change in handedness; there is a long line of friction between the two ropes or portions of a rope in the twist. Simple twists need to have the running end held in place by other knots or ropes or by the stiffness of the materials such as wire. Sometimes the knot will pull out under load to one more or less straight component with the other wrapped round it, a situation with less friction which should not be encouraged but cannot always be completely avoided.

TWISTS OF ONE HANDEDNESS



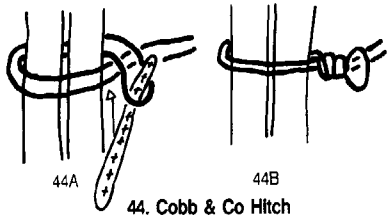
42. Knotless Netting

Knotless Netting (42) is used in some traditional societies for fish nets, though fish can sometimes squeeze through; it has some advantage in a hammock, making a more elastic network than firm knots. The mesh needs to be renovated from time to time. A double twist (42B) is more secure than a single twist (42A).



43. Binder Knot

The **Binder Knot (43)** is a quick binding traditionally used round a bundle of hay, corn and so on by twisting up a yarn of hay etc, wrapping it round the bundle, twisting the ends together in a tail (43A) and tucking the tail under the turn (43B). A similar binding can be made in other materials provided the knot is held in place either by roughness or by pressure, such as using a handkerchief as a bandage. A similar knot can be used to hold a rolled-down stocking in place—draw out and twist a tail in the roll, and tuck it inside the roll (43C).



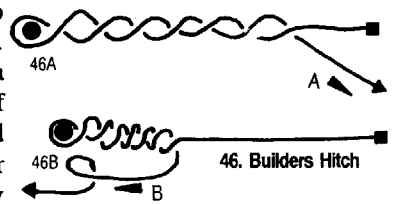
44. Cobb & Co Hitch

The **Cobb & Co Hitch (44)** is used as a usually temporary binding of two pieces

of timber using soft wire. Take a bight of the wire round the timber (44A) and twist the loop round the standing parts using a lever, preferably of metal (e.g. plier handles). The standing parts should both be long enough not to be buried in the knot (44B).

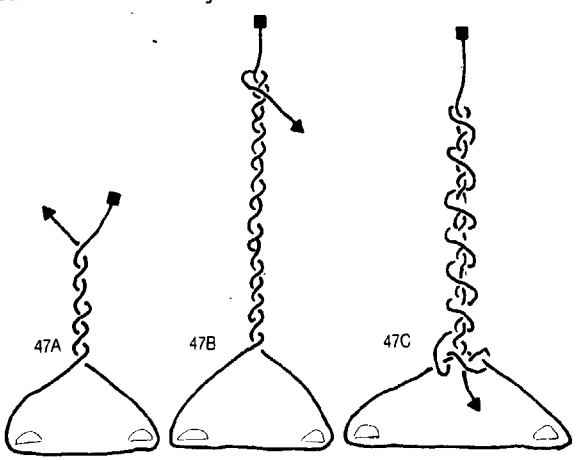
45. Haywire Twist

The **Haywire Twist (45)** is used to fasten fishing hooks to monofilament wire and consists of 5–6 turns of twists (as in 31A) followed by a similar number of wraps (as in 31B). The end can be either trimmed off short or left long to help retain the bait.



46. Builders Hitch

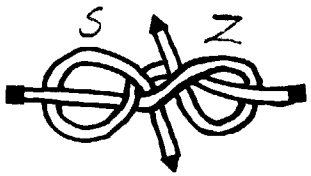
The Builders Hitch (46) is used to fasten a taut line to a nail or the like. Fasten the cord at the far end and make a bight of the near end at about the level of the nail. Insert a finger in the bight and make 4–6 twists, and place the bight over the nail (46A). Pull the running end really tight in the direction of arrow A. Taking care not to let the cord loosen, pull back the running end in the direction of arrow B (46B) and fasten with a Half Hitch over the nail; a second Half Hitch may be needed.



47. Bimini Twist

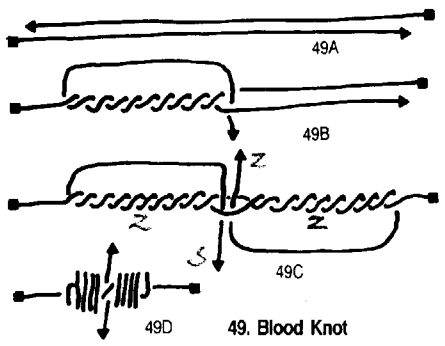
Big game fishers sometimes have a long loop, maybe several metres long, in the end of their lines, which they call a "double", for protection against heavy wear and handling. One of the ways to form a double is to make a **Bimini Twist (47)**, one of the strongest knots for nylon monofilament or braided lines. Make the loop of the required size; for long loops you may need to attach the opened out bight to something. Holding the two legs of the loop apart, make about 10 twists (47A). Keeping the twists firm, turn the end back (47B) and make another 10 or so twists in the opposite direction (47C). Another way to achieve the same result is to make about 20 twists initially, turn the end back as in 47B and spread the legs of the loop apart so that the lower twists unwind, forming a second layer of twists as in 47C; if dimensions are suitable, use your feet in the loop as indicated. Finish with a Half Hitch round

each leg of the loop (47C); for greater security extra Half Hitches, perhaps round the two legs together, may be added.



48. Strap Bend

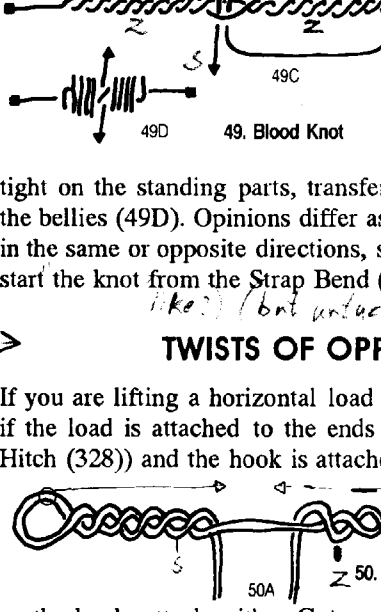
The **Strap Bend (48)** is specially useful to join leather straps, wire, wire rope and semi-stiff lines such as bamboo, also stiff hawsers. While secure enough in soft rope, it may jam tight. It consists of a Crossing Knot (318) and a Half Hitch; to tie in light lines under tension, make the Crossing Knot, pull tight and fasten with the Half Hitch. If the turns of the Half Hitch and the Crossing Knot are extended, the result is the **Blood Knot (49)**, probably the most popular knot for joining two monofilament fishing lines. If one line is substantially thinner than the other, make a long bight with it and make the knot with the doubled line. It is best made by laying the two lines together with an overlap (49A). From the midpoint, twist one running end round the other standing part 3–6 turns, and bring the end over the knot and down between the two lines at the midpoint (49B). Do the same with the other end (49C) and pull tight on the standing parts, transferring many of the turns from the spines to the bellies (49D). Opinions differ as to whether the two sides should be twisted in the same or opposite directions, so it probably makes little difference. If you start the knot from the Strap Bend (48) you get twists of the same handedness.



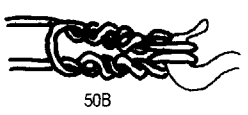
49. Blood Knot

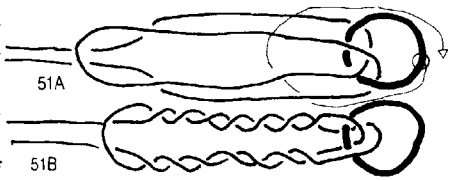
TWISTS OF OPPOSITE HANDEDNESS

If you are lifting a horizontal load on, say, a hook, you will get better control if the load is attached to the ends of the rope (or a sling using a Bale Sling Hitch (328)) and the hook is attached to the bight. To prevent the rope sliding on the hook, attach with a **Catspaw (50)**. Pick up a bight of the rope in each hand, palms up, and twist three times by turning the hands inwards, so that the knot appears as in 50A; place the two bights over the hook (50B). A very similar knot is used to attach a metal eye, as in a swivel, to a double fishing line (not wire). This is the **Offshore Knot (51)**, made by putting a bight of the double line through the eye and making a single twist (180°) in the loop by the eye and taking it down and on top of the doubled line (51A). Rotate the swivel through the middle of the loop at least six times (51B) and pull on the doubled line and the swivel to tighten. The only difference from the Catspaw (50) is the initial twist which adds a little to the security of the knot.

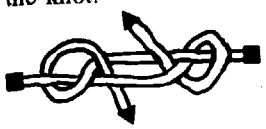


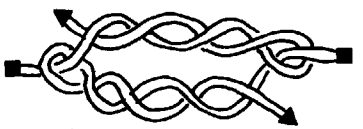
50A
50. Catspaw

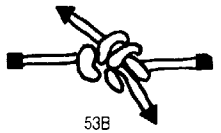

50B



51. Offshore Knot

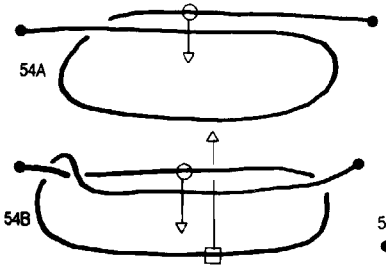

52. Double Strap Bend


53A


53B
53. Wire Bend

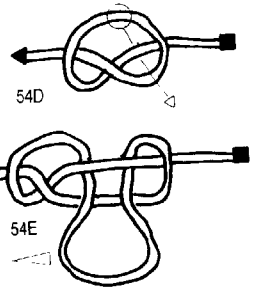
The **Double Strap Bend (52)** is a little more secure than the Strap Bend (48) for joining straps, wire or stiff cordage; with cordage and wire, it jams very tight. If each end of the Double Strap Bend is further twisted round its own standing part, you get a **Wire Bend (53)**, a good bend for wire, with the knot usually remaining like 53A. It is also a strong and secure bend for small to medium-sized cordage, which tightens to look like 53B; it is the easiest of all the multiple twist knots to untie. The basic form of each portion of the knot is that of the Timber Hitch (300).

In principle the Double Strap Bend (52) could be extended into a Blood Knot (49) with the twists of opposite handedness, by twisting the running ends with the standing parts of the other rope, but there is another way of achieving this which turns up some other interesting knots along the way. The starting point is to make a turn (54A) and half a twist with a bight of the upper standing part, following the circled arrow in 54A to 54B.


54A

54B

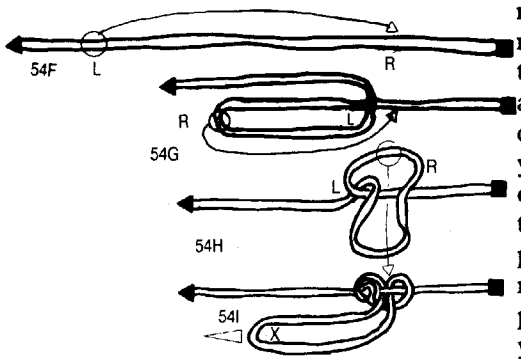
54C



54. Man Harness Hitch

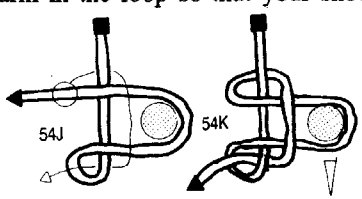
If then a bight of the belly is passed up through the twist, following the squared arrow of 54B, you get a **Man Harness Hitch (54C)**, a firm loop in the bight of the rope, used to give a grip for hauling on the rope and to make a rope tackle. It is often tied by making an Overhand Turn and casting it over the standing part (54D). Clasp the belly of the knot and pull it through the standing space (54E) and pull tight. This loop will hold well when pulled away from the standing end as indicated by the arrow, it also holds when pulling the

running end against the standing part, but it will take only a moderate pull between the loop and the running end. To make the loop big enough to harness a person, to haul on a rope with the shoulder through the loop, stand facing the rope with the load on your right, to pull to the left. Hold the rope with your hands about a metre apart (the final length of the loop), palms down, with your left and right hands indicated in 54F by L and R. Turn to the right and take a small pace forwards, turning your right hand (grasping the rope) palm up and keep it close to you and place the left hand over the standing part well ahead of you (54G). Grasp the crossover in your left hand and do not let it go until the knot is nearly tight. Move your right hand a little forward of your left, with the loop you are holding over the standing part (54H). Pick up the left side of this loop and pass it under the standing part and over its right side (arrowed in 54H) and pull tight; do not let go the crossover in your left hand until the knot is tightening on your thumb. Then turn left and insert your right arm in the loop so that your shoulder is at X in 54I and haul away.



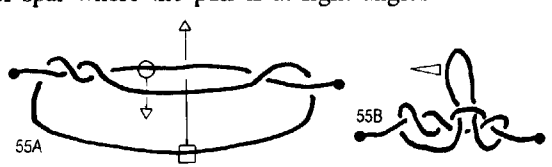
54. Man Harness Hitch

The Man Harness Hitch may also be used to hold the rungs of a rope ladder, working it down tight on to the rungs. In some situations (more than two ropes) you cannot pass the rungs through the loop and need to make the knot round them. Make an Underhand Turn and pass the running end round the rung (54J); then pass the running end back under the standing part, over the two legs of the loop and down and up through the Underhand Turn (54K). This way of tying the knot can also be used to fasten a rope to a ring or spar where the pull is at right angles.

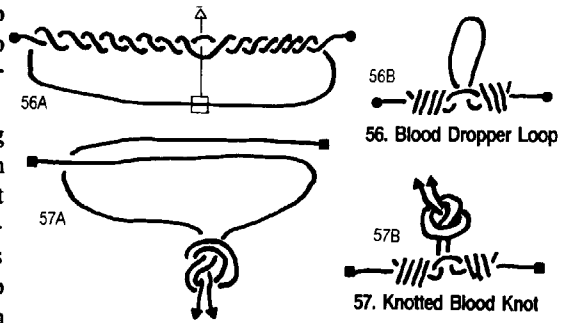


54. Man Harness Hitch

If you make another twist from 54B, following the circled arrow, you get 55A, and if you pass a bight of the belly through the twist as shown by the squared arrow of 55A, you get the **Double Man Harness Hitch (55B)**, more secure, specially for a three-way pull, than the Man Harness Hitch (54). This has been used to make a dropper loop in fishing line to attach an extra line and hook, but with nylon monofilament it is best to make 4–6 twists (56A) to make a **Blood Dropper Loop (56B).**



55. Double Man Harness Hitch



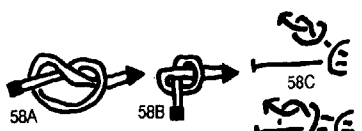
Finally, a way of tying a Blood Knot that is in some ways easier than that described in 49, particularly in difficult conditions such as in the dark, is to join the two ends with an Overhand Bend (130) and then (57A) go through the stages corresponding to 54A, 54B, 55A, 56A and 56B with the joined line, to get the **Knotted Blood Knot (57B).**

Chapter 8
OVERHAND KNOTS

A major family of knots consists of the Overhand Knot and its relatives. My primary division has been into essentially single Overhand Knots (Chapter 8) and paired Overhand Knots (Chapter 9), where in principle the knot is tightened only on to itself, and Half Knots (Chapter 10), where the knot is tightened down on to some other object. In all of these the main nip is in the twist held in place either by the belly of the Knot (Overhands) or by friction against the enclosed object (Half Knots).

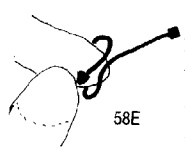
Most knots that are based on single twist Overhands have analogous knots based on multiple twist Overhands and also, as discussed later in Chapter 14, on single and multiple twist Figure Eight Knots. Most knots based on single twist Half Knots have analogous multiple twist Half Knots. I have mentioned only those analogues most in use or of particular interest. Load on many of these knots causes the twist to transfer to other parts of the knot, shown for example in 63A, 63C. This is normal and expected, and is usually an essential part of the knot. Tightening individual Overhand and Figure Eight Knots, single or multiple, results in different final forms depending on whether the tightening is between the two ends or between one of the ends and the knot itself; compare 58A and 58B; 62A and 62B; 63D and 63E; 279A and 279B; 280A and 280B; 281A and 281B; 283A and 283B.

UNMODIFIED OVERHAND KNOTS



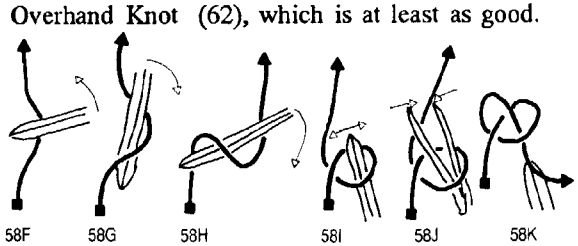
58. Overhand Knot

The simplest member of the series is the **Overhand Knot (58)**. It is a stopper knot, and for this purpose it should be tightened by pulling with the standing part in one hand and the knot in the other; the running end will finish roughly at right angles to the rope (58B). It is often used on the running ends of a knot to add security; I have called this a **stopped** knot if the Overhand is free (58C) or a **secured** knot if the Overhand Knot is tied to include the standing part (58D). If you tighten by pulling on both ends, the form of 58A remains, there is less cross-sectional area. The Overhand Knot, usually in the 58A form, may also be used as a temporary means to prevent the end of a rope from fraying or unlaying until a proper whipping can be put on. This should be regarded as an emergency measure only. The knot is weak (around 50%) and fairly secure, but it jams under strain and is hard to untie. If the Overhand Knot is used to hold beads in place on the thread of a necklace or the like, it is sometimes easier to tighten a fine thread up on to the bead by inserting a needle through the central space of the Overhand and use that to move the knot up close to the bead as you tighten it.



58E. Thumb Knot

The Overhand Knot is also called a **Thumb Knot (58E)** from the method of tying the knot in sewing thread. Take a turn with the thread round the forefinger, with the running end close to the standing part and not extending past the side of the finger (58E). Roll the end with the standing part with the thumb so that they twist together. Remove from the finger and push the knot down tight to the end. Sometimes you finish with a Double Overhand Knot (62), which is at least as good.

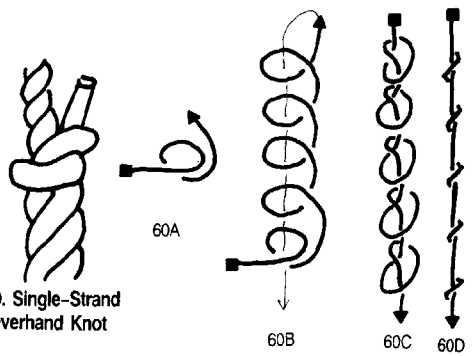


58. Overhand Knot

Sometimes you want to tie an Overhand Knot in thread in an awkward situation, as in modelling or in surgery, and it is then often easiest to use artery forceps or long-nosed pliers. Pick up a twist of the thread round the end of the forceps (58F, 58G, 58H), then grasp the running end in the forceps (58I, 58J) and draw the end through the knot, finishing as in 58K.

The **Single-Strand Overhand Knot (59)** is used to temporarily stop unlaying without the bulk of the Overhand Knot; it is less secure and is probably only applicable to rough natural-fibre rope. It consists of an Overhand Knot tied in one strand round the other two.

A Chain of Overhands (60) can be used to make a single rope ladder or lifeline or, in smaller stuff, as a lanyard knot. Make a series of Underhand Turns, one on top of the other (60A, 60B). It is easier to tie if you diminish the size of the turns as you progress, so that the last is the smallest, but this spreads the knots out unevenly. Then pass the running end down through all the loops as shown in 60B, forming Overhand Knots as the rope passes through each turn (60C). Pull tight (60D). It takes a lot of practice to do this quickly and get the knots evenly spaced; it is said that some sailors can heave a line to someone overboard, knotting it in this way as it goes. Good results can be obtained, more slowly but needing less practice, by making the Underhand Turns loosely over a wooden core whose circumference is about equal to the desired distance between knots.

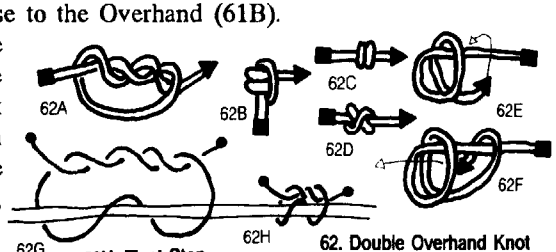


59. Single-Strand Overhand Knot
60. Chain of Overhands

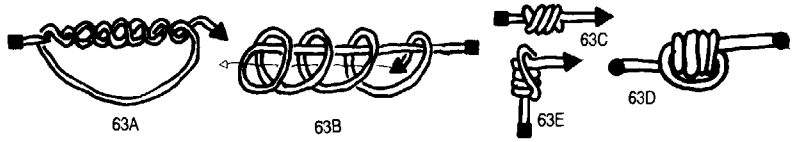
The **Banana Knot (61)** forms a more bulky stopper knot, best if the running end is relatively long or suspends a further load. As well as stringing hands of bananas, it has also been used stringing beads on multistrand silk. It consists of an Overhand Knot with a Half Hitch round the standing part (61A); the Half Hitch tends to prevent the knot jamming so badly under load, and should be worked close to the Overhand (61B).

61. Banana Knot

More twists to the Overhand Knot (58) can be made to increase the bulk or give more security; such multiple twist knots are common in fishing lines, specially in nylon monofilament, where single twist knots would not hold. Examples include the **Double Overhand Knot (62)** with two twists or the **Quadruple Overhand Knot (63)** with four. They can be tied in the same way as the single Overhand Knot (58) by making the twists (62A, 63A) and pulling on the ends. Normally the twists in the spine largely transfer to the belly, leaving when complete a single Overhand Knot in the original spine, covered with turns of the original belly. The final appearance is of a series of turns round the standing part (62C and its reverse 62D, 63C). The more turns, the more difficult it is to get them even, so an alternative means



62H. Float Stop
62. Double Overhand Knot

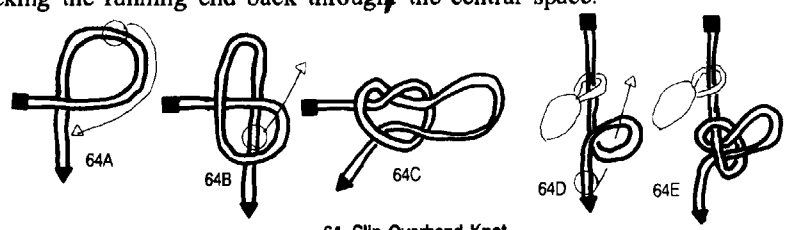


63. Quadruple Overhand Knot

may be used to tie them. Take the desired number of turns along the standing part towards the standing end (62E, 62F; 63B). Then push the running end through the loops (62F, 63B) and pull tight. This method can also be used to tie the knot round an object, as in the Nail Knot (94) and the Double Fishermans Knot (109). This form of the knot is sometimes called the **Grapevine** form. It is a long and relatively thin knot, more decorative than the single Overhand, and of a length that can be varied by varying the number of turns. Indeed, the knots have been used to identify cords or section of cord by the number of turns; the Incas used these cords, called quipus, with the knots in the **Open Form** (62B, 63D), to keep records of astronomical information, census data, laws and other things. For use as stopper knots it is best to tighten by pulling the standing parts of 62A and 63A against the knot, to give 62B and 63E, with the running end sticking out. The Double Overhand Knot can also be used as a **Float Stop (62H)** to prevent a running float etc travelling along a line. Tie it by putting a twist around the main line and make the Double Overhand Knot on top (62G); when tightening ensure that no kinks form in the main line.

RUNNING END THROUGH CENTRAL SPACE

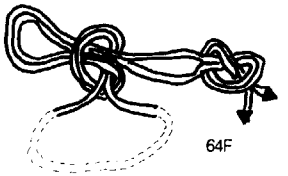
In principle, these knots may be formed from the simple Overhand Knots by tucking the running end back through the central space.



64. Slip Overhand Knot 64E. Release Knot

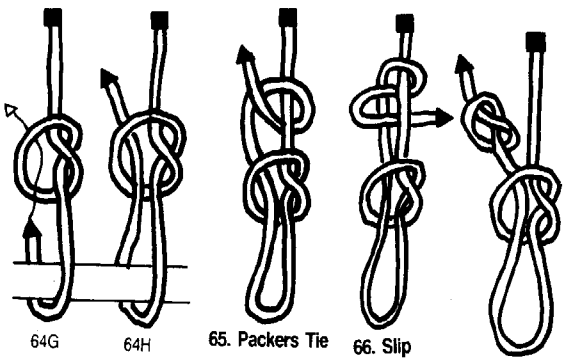
A Slip Overhand Knot (64) is a quick release stopper knot of greater bulk than the simple Overhand (58). It can be made as shown in 33A or 33C, but sometimes it is more convenient to make an Underhand Turn (64A), place the loop over the running end (64B) and pull a bight of it through the loop (64C). It can also be used as a **Release Knot (64E)** in long traces of a fishing line. A weight (which should have a narrow eye) is held a long way from the hook until a firm strike is made, when the knot is spilled and the weight can move down to the hook. Make a turn below the weight (64D) and pull through

the bight of the running end (64E). Made in doubled rope, it forms a **Drawstring Slip Stopper (64F)**, a quick release knot keeping tight the drawstring of a bag, or if you like, your pyjamas; some mechanical binders tie this knot round bundles of hay etc.



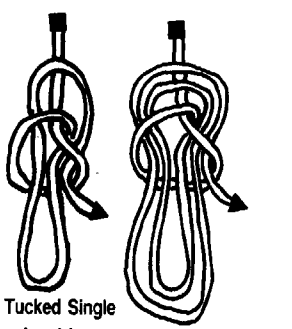
64F. Drawstring Slip Stopper

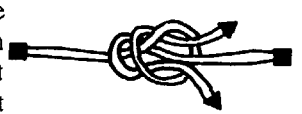
A Slip Overhand can be converted into a fixed loop by fastening the running end or by tucking it back into the knot. For these purposes, it may of course be necessary to cast the Slip Overhand over an object as shown in 64G, 64H. Probably the simplest method of fixing the loop is, after adjusting the loop in length and tightening the Overhand, to make a Half Hitch with the running end round the standing part behind the Overhand Knot to form the **Packers Tie (65)**. If the Half Hitch is made in the bight, you have a **Slip Overhand Loop (66)**; alternatively, stop the running end with an Overhand Knot (preferably of the same handedness) to get a **Store Knot (67)**. All these knots are most used as running loops in tying up parcels, though the Packers Loop was used as a leader loop in gut fishing lines.



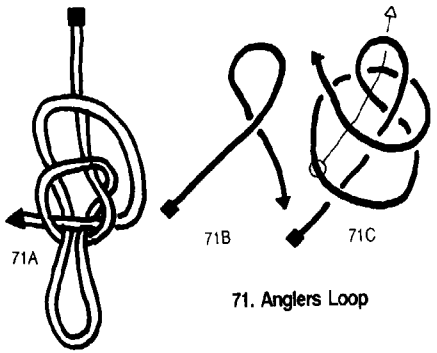
64. Slip Overhand Knot

The second way of fixing the Slip Overhand is to tuck the running end into the knot; these knots can jam tight, though can be made in the slipped form. Probably the simplest is the **Tucked Overhand Single Loop (68)**, made by taking the running end above the Overhand as shown, and into the running space beside the bight; it is not very secure in stiff synthetic ropes. It is easy to make a double loop by making the running end follow the bight round, through the Overhand and back into it, making a **Tucked Overhand Double Loop (69)**, which is more secure. The same formation is found in the **Binder Turn (70)**, a simple non-bulky bend with both ends close to the standing part so that the knot will easily pull through obstructions. It jams tight and is neither particularly strong nor particularly secure, specially in stiff synthetics, but it is often used in binder twine; if one


68. Tucked Single Overhand Loop 69. Tucked Overhand Double Loop

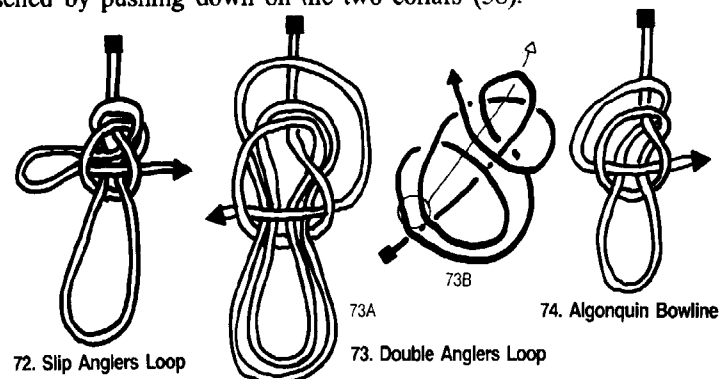

70. Binder Turn

cord is thicker than the other, the thicker cord should make the open loop.



71. Anglers Loop

One of the most reliable loops in fishing line is the **Anglers Loop (71)**. It can be made from the Tucked Overhand Single Loop (68) by passing the running end over the bight and into the belly of the knot, pulling tight with care (71A). The knot can also be made in the bight, without using the ends, by making a fairly small Underhand Turn (71B) with a long running end; hold the crossover until the knot is complete. Take the running end over the standing part (the size of this turn controls the size of the final loop), behind the Underhand Turn and over the standing part again (71C). Then pass the bight of the big loop down through the underhand turn and carefully pull tight. This knot tends to jam when tied in rope, but it can usually be loosened by pushing down on the two collars (38).

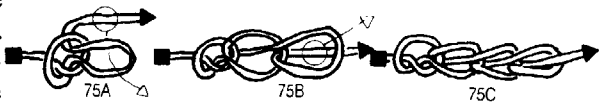


72. Slip Anglers Loop
73. Double Anglers Loop
74. Algonquin Bowline

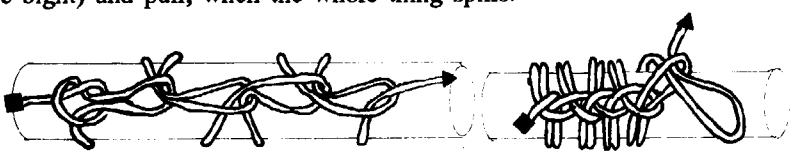
Alternatively, make a **Slip Anglers Loop (72)**, having the slipped bight pass under two tucks. The **Double Anglers Loop (73)** forms two loops. It can be made from the Tucked Overhand Double Loop (69) by tucking the running end as before (73A), or, in the bight, by taking two turns over the standing part (73B) and continuing as for the single knot.

The so-called **Algonquin Bowline (74)** (it is not related to the Bowline) is another secure loop that has been suggested for climbers, though it also jams badly; I do not know how well, if at all, it has been tested. It is like the Anglers Loop (71) but with the running end tucked through the Overhand Knot from the other direction; it should be started from a Slip Overhand (64), taking the running end round in the opposite direction to the Tucked Single Overhand Loop (68).

A decorative and fairly elastic shortening for a rope is the **Chain Sennit (75)**; it can be used in the seat of a chair knot to provide some comfort, and is also used in the Chained Coil (29). Start with a Slip Overhand (64; 75A), close to the standing end if you want to use the whole rope, and pick up a bight of the running end through the loop (75B). Continue as desired and finish by passing the running end through the last loop (75C). If you are tying the sennit in the bight of the rope with the running end unavailable, seize the last loop to the running end or finish like the Sheepshank (364E,F). To untie, be careful to start from the finishing end, not the start; just remove the last tuck (or the other finishings for the bight) and pull, when the whole thing spills.



75. Chain Sennit

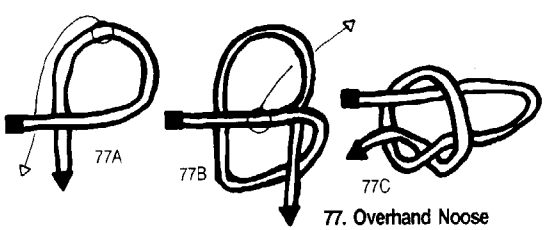

76A. Chain Serving
76B. Chain Coxcomb

The Chain Sennit (75) can be tied round an object. A **Chain Serving (76A)** has the turns spread out to make a quick wrapping for awkward bundles. It can be used to tie a patient in a stretcher, and I have been told that it has been used to make emergency snow or mud chains for car wheels (it would wreck the rope). It is made like the ordinary Chain Sennit (75) except that each bight is passed round the object before entering the preceding loop. A **Chain Coxcomb (76B)** has the turns close together and in line, a decorative covering for rails, steering wheels and the like.

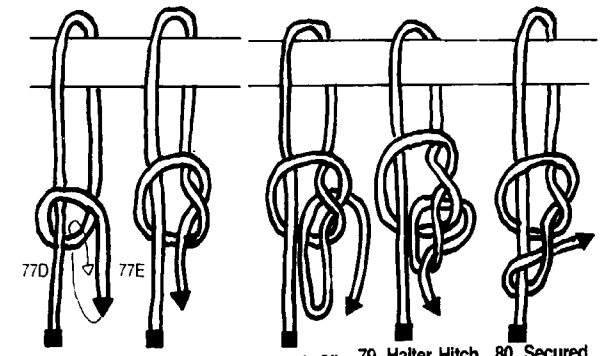
STANDING PART IN CENTRAL SPACE

The basic knot in this series is analogous to that in the previous group, with the standing part and running end interchanged.

The **Overhand Noose (77)** is a simple noose; it is often used as a slip knot for tying up parcels. If the other end of the twine is passed through, the noose will draw up tight round it; or make the knot as a Running Loop (35) round the main standing part, and tying an Overhand Knot (58) round the immediate standing part; this is 77D, 77E shown round an object, like 64G, 64H. It is also used as a snare, and as a quick attachment to a ring or anchorage; it used to be used to tie a gut line to a fishing hook or swivel. It may be



77. Overhand Noose



77. Overhand Noose

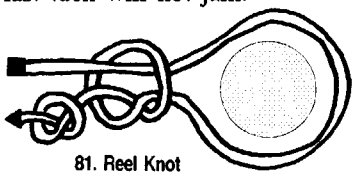
78. Slip Overhand Noose

79. Halter Hitch

80. Secured Overhand Noose

tied by starting with an Underhand Turn (6C; 77A), moving the turn under the standing part (77B) and drawing a bight of the standing part through it (77C).

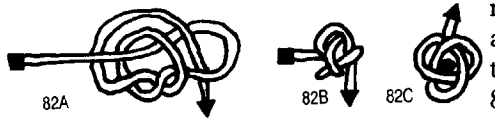
A **Slip Overhand Noose (78)** is made by taking a bight instead of the running end in 77D through the turn. For greater security in a quick release knot, make a **Halter Hitch (79)** by passing the running end in 78 through the slip loop. This will not work loose if the running end is longish and the slip loop smallish, and is good for tying up animals etc. It is easily released because the last tuck will not jam.



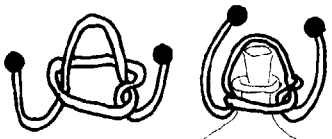
81. Reel Knot

The Overhand Noose (77) can be made more secure for attaching a line to an object by making a Half Hitch in the running end round the standing part to form a **Secured Overhand Noose (80)**. Another way is to make an Overhand Knot in the running end, best of the same handedness; this forms a **Reel Knot (81)**, which has been used to fasten a fishing line to a reel: pull the noose tight before making the Overhand close up.

The **Oystermans Stopper (82)** is a large symmetrical stopper knot, tied by making an Overhand Noose (77) and passing the running end through the loop as shown in 82A. Pull tight, keeping the standing part in the centre of the knot and the end running out at right angles (82B); the end-on view is as shown in 82C.



82. Oystermans Stopper

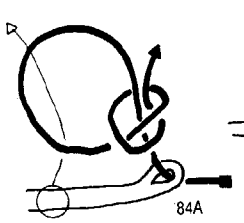


83. Cork Tie

A **Cork Tie (83)** holds a cork in a bottle against pressure. Start with an Overhand Noose (77; 83A), place it over the cork and the neck of the bottle (83B), tighten the Overhand and then the ends before fastening them together on the top of the knot with a Reef Knot or a Slip Reef or the like. If the cork is very hard or slippery, cut a couple of grooves to hold the twine in place.

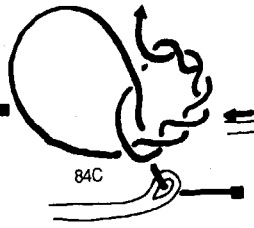
Turle Knots (84) are used to tie an eyed hook, specially an angle-eyed

hook, to a fishing line. With the angle eye pointing up, pass the line up

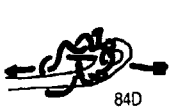


84A

84B



84C

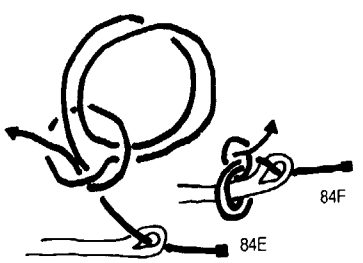


84D

84B. Turle Knot

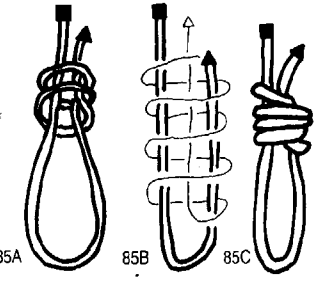
84D. Treble Turle Knot

through the eye and tie a noose; pass the hook through the noose (taking care if there is a fly tied to the hook) and tighten the noose. The simplest **Turle Knot (84B)**, satisfactory for gut and, for some, nylon, is made by tying an Overhand Noose (84A), unlike 77 in having the ends crossed, passing the hook through the noose and drawing tight (84B). Most people like a more secure knot than this for nylon; I show two variants. A **Treble Turle Knot (84D)** uses a Treble Overhand Noose (84C), though some find a Double Overhand Noose satisfactory; pass the hook through the noose and pull tight, trapping the running end in the noose (84D) against the curve of the eye. The **Two-Circle Turle Knot (84F)** is made by passing the line through the eye, making two turns and tying an Overhand Knot over the junction of the two turns (84E). Pass the hook through the two turns and tighten round the eye (84F).



84F. Two-Circle Turle Knot

The **Poachers Noose (85)** is a Double Overhand Noose (tied in the Grapevine form, 62F), a good noose in light to medium rope. It holds its form better than an Overhand Noose (77) when unloaded and is more secure, though under a heavy load it will jam tight. It has been used as a snare and, in twine, for tying parcels. With more turns, at least four, it has been used as a **Gallows Knot (85C)**, started as in 85B.

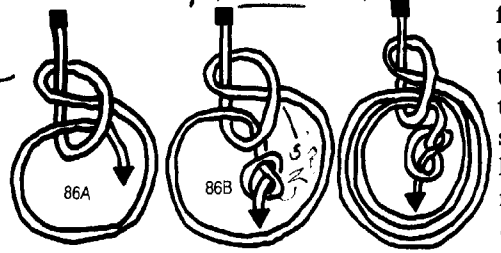


85. Poachers Noose 85C. Gallows Knot

USE OF OTHER SPACES

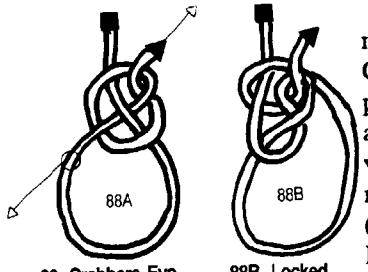
In principle, these knots can be formed by tucking the running end or the standing part, as appropriate, into one of the other spaces of the basic Overhand.

Simple Overhands



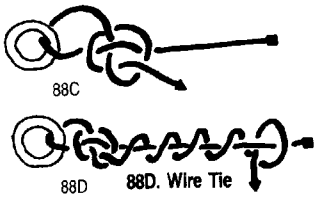
86A. Bowstring Knot 86. Honda Loop 87. Double Honda Loop

The **Honda Loop (86)** forms the eye in a lariat noose, the free circular shape allows the standing part to feed freely through. It has also been used to string a bow. Make an Overhand Knot (58) and pass the running end round in a circle and into the running space (86A); in this form it is called a **Bowstring Knot**, formerly used to string a bow. Stop the knot with an Overhand Knot, preferably of the same handedness (86B). A **Double Honda Loop (87)** with an extra turn through the initial Overhand Knot, suffers from less wear by sharing the load.



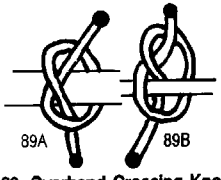
88. Crabbers Eye 88B. Locked Crabbers Eye

The **Crabbers Eye (88)** is a high friction noose that could be considered a Running Overhand Noose with the loop of the noose pulled straight. Tied tightly in natural rope and then subjected to a heavy load it jams very tight. It has been used to secure the running end of such knots as the Bowline (400), the Clove Hitch (372) or the Cow Hitch (379), where the running end makes the knot of 88A round the standing part of the knot. After adjusting the size of the loop, it can be capsized into a fixed loop of moderate strength and security by pulling on the two ends as indicated on 88A. This form (88B) has been called a **Locked Crabbers Eye** and is related to the Sheetbend/Bowline family. The **Wire Tie (88D)** fastens plain or nylon-covered fishing wire line to a swivel etc. Cast a Crabbers Eye (88A) round the swivel (88C), pull it tight and hard against the swivel and wrap the running end round the standing part for about four to five turns and finish with a Half Hitch (88D).



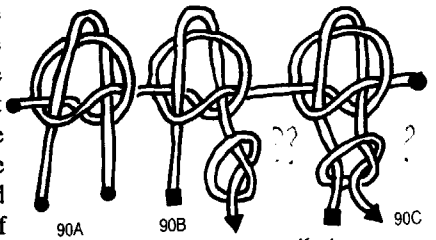
88C

88D 88D. Wire Tie



89. Overhand Crossing Knot

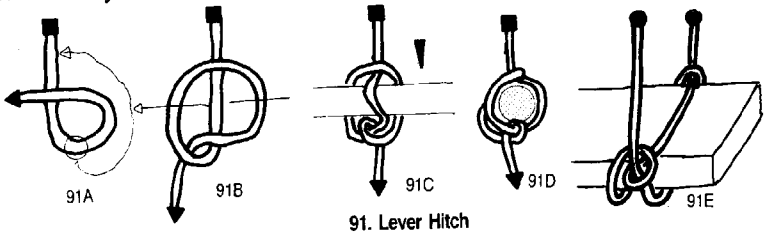
The **Overhand Crossing Knot (89)** uses an Overhand Knot as a crossing knot in one of two forms. If the object being crossed is of much greater diameter than the cord, it is satisfactory to use the central space of the Overhand (89A). If the object is of similar diameter, a stiff cord cannot draw really tight, and it is best to use one of the other spaces (89B). This has been used in square netting.



90. Overhand Dropper Knot

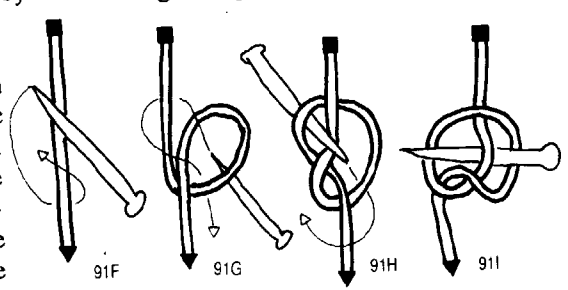
A secure dropper fly hitch is the **Overhand Dropper Knot (90)**, where the dropper line is inserted through one of the side spaces of an Overhand Knot (58) tied in the main line, round the belly and back through the other side space. Both ends may take hooks, and the knot is of the form of 90A, but if only one hook is used, the running end must be stopped with an Overhand Knot, either alone (90B) or round its standing part (90C).

It is easier to pull on a rope by means of a cross spar than on the bare rope. One way of inserting the spar is by means of a **Lever Hitch (91)**, which



91. Lever Hitch

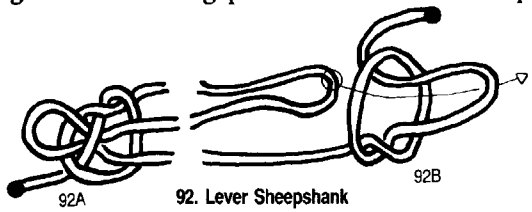
can take a pull in one direction only, indicated by the arrow in 91C. An effective rope ladder can be made with two ropes and round wooden rungs held in place with Lever Hitches. Grooves in the rungs make the knots more secure and should be used for permanent jobs. The knot can also be used to suspend the end of a plank by inserting it into a Lever Hitch (91E) and supporting the weight on both ropes, perhaps joining them with a Bowline (400). To tie it, face the load, throw an Overhand Turn in the rope (91A) and turn it over the standing part (91B). Insert the lever between the loop and the standing part (91C) and pull tight so that the rope is symmetrically arranged around the spar (91D); the knot is spilled by withdrawing the spar.



91I. Marlinespike Hitch

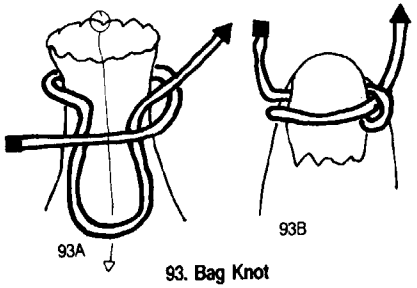
The knot is also known as a **Marlinespike Hitch** from its use in tightening seizings etc using a spike in the twine. 91F–91I show how make the knot round a marlinespike; the arrows show the path of the point of the spike. Place the spike over the standing part (91F), flick the point down, behind the standing part and back up to give a Half Hitch with the spike pointing up in it (91G). Slide the spike up, behind the standing

part and back over it (91H); finally slide it down, over the standing part but under the Overhand and then around to the horizontal (91I), and pull back against the standing part. Practice makes this quick and easy.



92. Lever Sheepshank

The **Lever Sheepshank (92)** is much more secure against a fluctuating load than the ordinary Sheepshank (364), used to shorten a rope, but it cannot be tied to finish with the rope tight. The bights are inserted (92B) through Lever Hitches instead of Half Hitches.

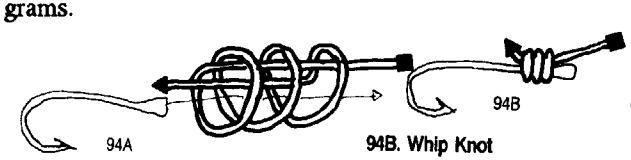


93. Bag Knot

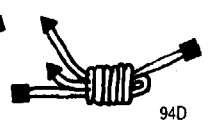
The **Bag Knot (93)** is a way of binding the neck of a not too full bag, carrying the bag by the rope. Take a turn round the neck of the bag and push a bight of the running end under the turn (93A). Bend the neck of the bag through the bight and tighten (93B). The bag may be carried by the standing part or, if not too heavy, by the running end. It may be convenient to join the two to give a handle. If the bag itself is to be handled a lot, it would be best to bind the two ends tight round the neck with a Reef Knot or something; the ends could still be used to take the weight.

Multiple Overhands

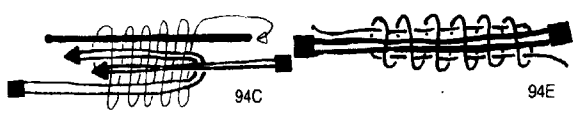
The last group of knots in this section uses the interior and vertebral spaces of multiple overhands in the Grapevine (62F) or Open (62A) form. These are almost exclusively used for fishing lines; for nylon monofilament usually at least five turns are recommended, not always indicated in the diagrams.



94B. Whip Knot

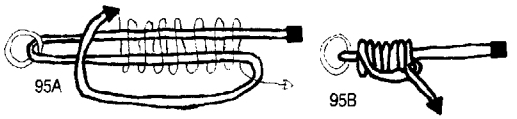


94D. Nail Knot

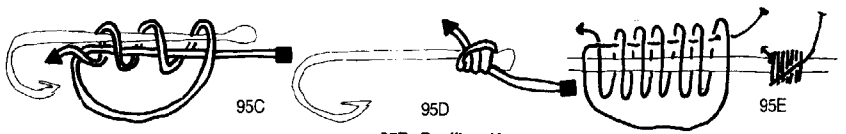


The **Whip Knot (94B)** joins a line to a blind (spade-end or tad) hook. Form the Multiple Overhand Knot in the Grapevine form (94A), insert the shank of the hook and tighten (94B). The knot may also be made as a **Nail Knot (94D)**, which itself is also used to tie a line to a bight of wire (94C,D)

or as a movable stop for floats or light weights (94E). A nail, needle or small tube (such as the ink tube from some ball point pens, or even a sturdy straw) is held over the wire bight (94C) or standing part etc. The line used for binding is then taken along the nail etc and wound back along its own standing part (94C) the desired number of turns. The running end is then passed through the turns (94E), either alongside the nail, through the tube or threaded into the needle and carefully worked tight as in 94D, keeping the turns in order.



95B. Grinner Knot



95D. Snelling Knot

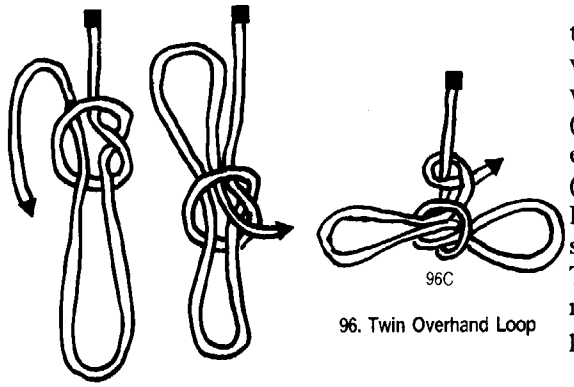
Multiple Overhands in the Open Form are used in the **Grinner Knot (95B)** which is used to tie any line to a hook or swivel, also to attach the line to a reel arbor. Pass the running end through the eye (95A), or several times round the arbor, then form a loop (95A) and wrap the end several times round the two lines towards the standing part (95A) and carefully pull tight (95B). Tied in doubled line (specially of braided nylon), the knot is used to tie the bight of a game-fishing double to a swivel etc. The same knot is called a **Snelling Knot (95D)** to tie a line to either a blind hook (95C, 95D) or an eyed hook (pass the end through the eye and tie the knot over it). Make a fairly large loop and wrap the end back along the standing part (including the shaft of the hook) (95C). Pull tight (95D), taking care to keep the turns in order without riding, and the belly of the knot over all. The knot has also been used to fasten on a dropper line; tie one end of the dropper line to the main line (95E), and attach a hook to the other.

Note that 94E and 95E are exact equivalents in the Grapevine and Open form respectively. All the forms in 95 may be converted to the Grapevine form and, with more difficulty, all the forms in 94 may be converted to the Open form if appropriately manipulated while tightening. The resulting knots would probably not be very different in function.

DOUBLE LOOPS IN OVERHAND KNOTS

These knots can be imagined as having both ends of an Overhand Knot tucked into the central space and perhaps interlaced, perhaps with the belly of the knot.

The **Twin Overhand Loop (96)** consists of two loops at right angles to

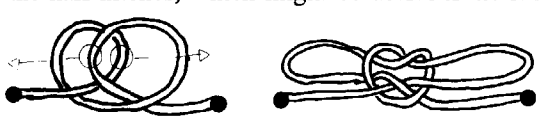


96. Twin Overhand Loop

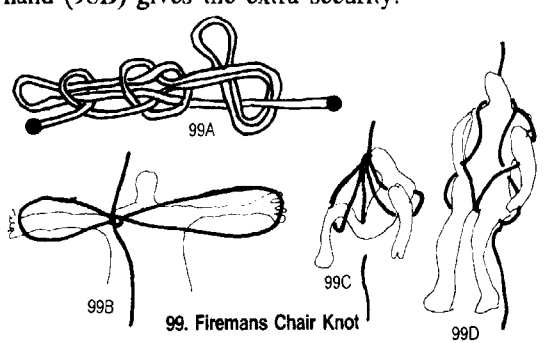
the standing part. Start with a Slip Overhand (64) with a long running end (96A), return the running end into the central space (96B) and secure with a Half Hitch round the standing part (96C). Tighten by pulling on running end and standing part.

97. Tom Fools Knot

The **Tom Fools Knot (97)** is tied by making two Underhand Turns, with the second below the first (97A) and passing the near side of each through the other (97B). It has been used for handcuffs: put a hand through each loop and join the two ends with a Reef Knot or make a Half Hitch with each end round the adjacent bight. It has also been used as a bottle knot: put the neck into the central space of the Overhand, join the ends with a Reef Knot and use the loops as handles. The knot can also be used instead of the S-bend to tie a Sheepshank (364); the knot holds the loops in place while making the half hitches, which might be useful if the loops are long. A slightly more secure knot for these purposes is the **Handcuff Knot (98)**, tied in a similar manner except that the first Underhand Turn is placed under the second (98A). The crossover of the ends in the belly of the Overhand (98B) gives the extra security.



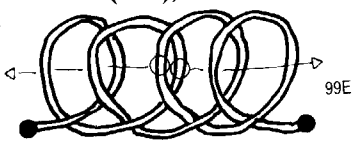
98. Handcuff Knot



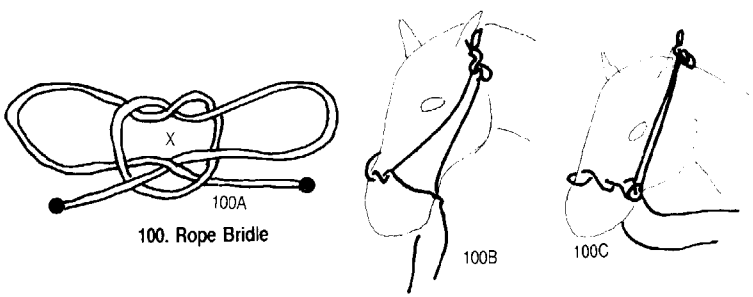
99. Firemans Chair Knot

The **Firemans Chair Knot (99)** forms two loops in the bight of a rope that is secure in natural rope but not quite so secure in synthetics. Start with a Tom Fools Knot (97) or, better, a Handcuff Knot (98) and spread out the loops to the required length. For use as a chair spread the loops from hand to hand of the outstretched arms (99B), with the knot level with one shoulder. Then put Half Hitches in the standing parts round each loop tight

against the Overhand Knot (99A); it is often convenient to make the Half Hitch with the loop (99A) and then transfer it (30) to the standing part. The short loop is then placed under the shoulders and the long loop under the knees of the person to be carried (99C), who should then hold on to the knot which will be level with the head. Like all chair knots, this is insecure for an unconscious or helpless person. If it is desired to lift the person in a more upright position, either because of the route to be traversed or because the person needs to avoid a bent position, the knot may be used as a **Richardson Harness Knot (99D)**. Make the knot with equal loops, at least as long as the longer one in 99B; with the rope behind the person, put a twist in each loop, step into it and place the arms through above the twist (99D); the knot should be behind the head. Hold on to the ropes across the chest. The Firemans Chair Knot can be made in one motion if only short loops are wanted; make four Underhand Turns, each over the preceding one (99E) and pull the loops through as indicated.

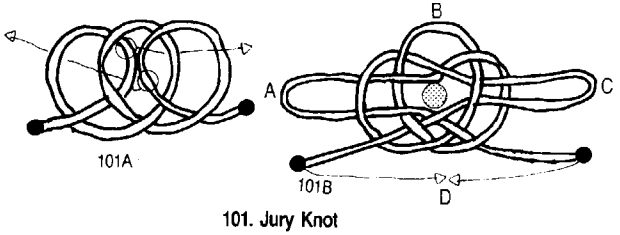


99. Firemans Chair Knot



100. Rope Bridle

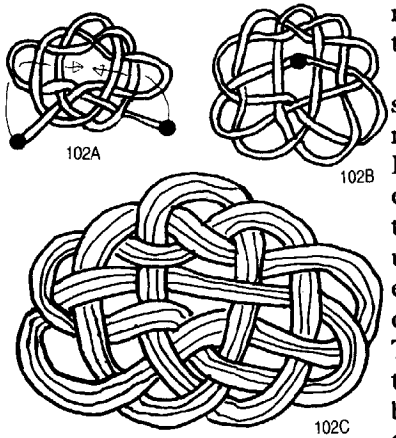
A similar knot can be used as a **Rope Bridle (100)**. Make a Handcuff (98) or Tom Fools (97) Knot and pass the horse's nose in the central space at X (100A). Knot the loops with a Reef Knot behind the ears (100B) and the ends round both legs of each loop (100C) with one or two Half Hitches and use them as reins.



101. Jury Knot

The **Jury Knot (101)** can be used to produce from two to five loops emerging from a knot gripping tightly round an object. Make three Underhand Turns, each over the preceding one (101A). Pull the inner edges of the outside loops through the opposite loops as shown (101B). This makes a decorative bow in a bight; if any strain is put on you will need Half Hitches over the loops as in 99A. For loops round an object, place the object through the central space

(101B). For two loops, join the two ends with a Reef Knot at D; this can provide handles for a pitcher, jug or bottle. For three loops, pull out the centre loop B and join the two ends with a Reef Knot at D. The classic use for the knot is to provide fastenings for four stays for an emergency or jury mast at sea. Pull out loop B, place the knot over the mast and join the ends at D in a Bowline with the knot in the loop of the Bowline. Make fast stays to loops A, B and C with Becket Hitches (396) and use the standing part of the Bowline at D either as the fourth stay or to join on to the stay with, perhaps, a Sheet-bend (395). A collar of some sort is needed below the knot to prevent slipping down the mast; a West Country Whipping (13) or wooden wedges will serve. For five loops, make a Bowline in each running end. Note that whatever the number of loops a load must be maintained on each if the knot is to hold.



102. Jury Mat

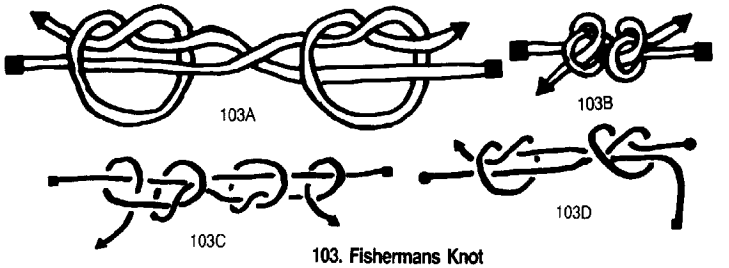
An interesting mat with only unilateral symmetry, the **Jury Mat (102)** can be made from the preceding. Make a Jury Knot (101) with short loops in the middle of the rope (102A). Pass the ends round the end loops and interweave over and under into the centre (102B). Take each end in turn and follow each tuck of the other until you come back into the centres. This gives a mat of three turns (102C), but the process can be adjusted to suit. Finish by sewing the ends to the underneath of the mat out of sight.

Chapter 9
PAIRED OVERHAND KNOTS

A large number of bends can be made by, in effect, having an Overhand Knot (58) in each rope and juxtaposing or interweaving those knots in various ways. Many of them have analogues using Multiple Overhands. Many of these bends can be made the basis of loops and other formations. Many of the knots developed following Harry Asher's system are the result of interweaving Overhand Knots. Only a few of these possibilities are shown here, mainly the most commonly used.

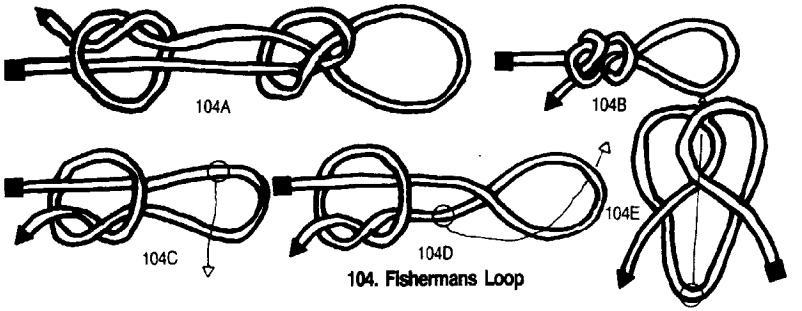
ADJACENT OVERHANDS

The most simple arrangement keeps the Overhands separate but each has one end of the other passing through one of its spaces.



103. Fishermans Knot

The **Fishermans Knot (103)** is a bend well-known in gut fishing lines but also used in rope where it may jam tight; it may slip in synthetics. It is quite suitable in soft wire or in vines or the like. Overlap the two lines and make an Overhand Knot (58) of the same handedness in each running end enclosing the other standing part (103A). Pull the Overhands tight and work them together (103B). If the Overhands are of different handedness, you may need to match belly against spine rather than spine to spine. For greater security, make a Half Hitch with each running end on the adjacent standing part (103C). It can also be used to fasten a dropper lead to the main cast (103D). Make an Overhand Knot in the main cast, insert the running end of the lead through the Overhand in the direction of the standing end and fasten it with an Overhand of the same handedness over the standing part.

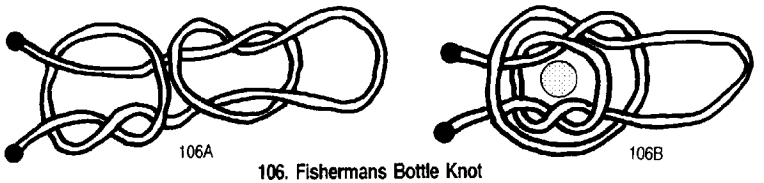


104. Fishermans Loop

The **Fishermans Loop (104)** was often used in gut fishing lines, but it is not very secure in nylon; it is also better in natural fibre rope than synthetic, where it is apt to jam too tight. It can be tied by making an Overhand Knot (58) in the standing part, forming a loop in the running end (perhaps round the object it is intended to enclose), pass it through the central space of the Overhand and make another Overhand of the same handedness round the standing part (104A). When pulled tight the two spines should be together (104B). The knot may also be tied in the bight by making an Overhand Noose (77; 104C),

putting a twist in the loop (104D) and passing a bight of the running end through the loop as shown. The knot with Overhands of opposite handedness may be readily tied in the bight by holding the rope in the two hands (a bit further apart than will be needed for the loop), take a twist inwards with each hand and place the standing part loop over the running end loop (104E). Take the bight through the overlap loop as shown. Again, you have to match belly against spine. In the early days of mountaineering this knot was sometimes used to fasten the middle person of a climbing party into the middle of the rope. Unfortunately this knot becomes a noose if the strain is taken on the rope shown as the running end in 104A. This could be prevented by loosening the inner Overhand in 104A and passing it over the knot, so that it capsizes into a Half Hitch; this was called a **Middlemans Loop (105)**. The very similar knot tied starting with Overhands of differing handedness (as in 104E) is more liable to jam.

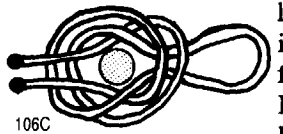
105. Middlemans Knot



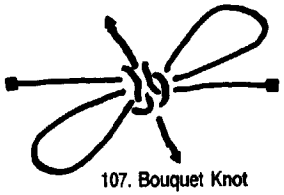
106A 106B

106. Fishermans Bottle Knot

The **Fishermans Bottle Knot (106)** can be made in a sling or single rope. Make a loose Fishermans Loop (104; 106A), open out the inner Overhand and pass it around the outer Overhand and place the knot around the bottle or other lipped object (106B) and pull tight; if necessary, join the ends. Note that the two Overhands were adjacent, that is, separate, in 104 but are now in 106B linked with the belly of one knot through the standing space of the other. If you use Overhands of different handedness (from 104E) to form a Bottle Knot in the same way (106C), they remain separate. It seems likely that the knot with linked Overhands is a little more secure. Both 106B and 106C can be tied in a sling, so that there are no ends to join.



106C



107. Bouquet Knot

The **Bouquet Knot (107)** is a Fishermans Knot (103) with both ends slipped (it can also be based on a Double Fishermans Knot, 109). Several different appearances can be obtained by arranging the slip appropriately. To tie round a bouquet or the like, make an Overhand slipped in the desired way round the other standing part and pull tight, then make the other slipped Overhand, keeping it as tight as possible.

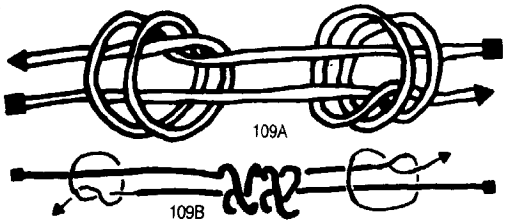
The **Overhand Adjustable Bend (108)** allows the combined length of two

joined ropes to be varied whilst being fairly secure (security depends very much on the nature of the cord). Make Overhand Knots (58) in each cord well back from the running end. Insert each running end into the running space of the other Overhand and tighten both knots. Each Overhand grips tighter than in the Fishermans Knot (103) because the pull comes to it direct, not after passing through another knot; the use of the running space gives maximum friction. As a safety precaution it may be desirable to stop each running end with an Overhand Knot.

108. Overhand Adjustable Bend

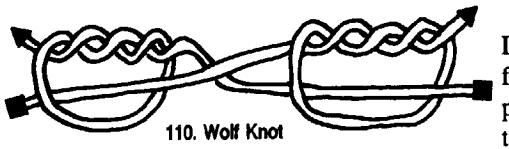
Analogues of the Fishermans Knot (103) may be made using Multiple Overhand Knots in the open (62A) or grapevine (62F) formation, enclosing the standing parts in the central, vertebral or interior spaces.

The **Double Fishermans Knot (109)** uses Double Overhands in the grapevine form with the other standing part in the interior space. It is satisfactory for gut but still insecure in nylon fishing lines. Tied in rope, it does not jam as tight as and is more secure than the Fishermans Knot and is the strongest bend for modern kernmantle ropes. The two ropes do not have to be exactly the same size. Mountaineers sometimes go for extra security by using Triple Overhands instead of Double. Some people secure the ends with Overhands as shown in 109B; sometimes this is done merely to ensure a tail of adequate length, with the knot keeping the tail out of the way.



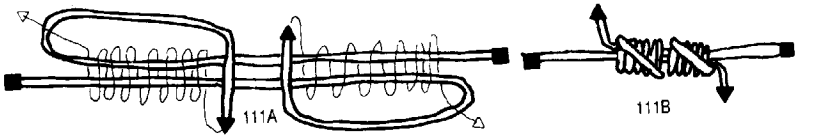
109A 109B

109. Double Fishermans Knot



110. Wolf Knot

The **Wolf Knot (110)** uses Double Overhands in the open form, with the other standing part in the central space; tighten the Overhands before drawing together. It has been used to join two nylon fishing lines of about the same size.



111A 111B

111. Double Grinner Knot

The **Double Grinner Knot (111)** uses Multiple Overhands in the open form, with the other standing parts in the vertebral spaces, and is used to join any type of running fishing line. Overlap the lines and take the running ends

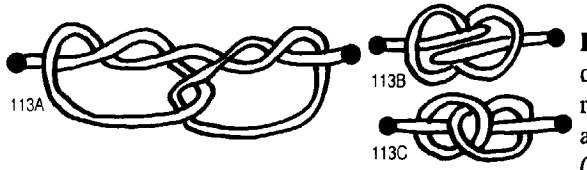
back to the middle (111A). Then wrap each end as in a Grinner Knot (94) round the two lines working outwards for 4–6 turns and work tight (111B). Note that this knot uses multiple Overhands, in comparison with the Blood Knot (49) where the running ends are merely trapped in the twists.

112. Double Fishermans Loop

The **Double Fishermans Loop (112)** uses Double Overhands as in the Double Fishermans Knot (109). It is one of the strongest and most secure end loops for kernmantle rope. Unfortunately it tends to jam badly under load so it might be considered for a permanent loop rather than a temporary one. You get more trouble with this knot jamming than with the corresponding bend, the Double Fishermans Knot (109). This is presumably because the Overhand Knot closest to the loop has a load on both ends, unlike the other knots in 112 or 109 which are loaded on one end only to pull the two Overhands together. A Triple Overhand Loop, using Triple Overhand Knot, has been used on some special ropes.

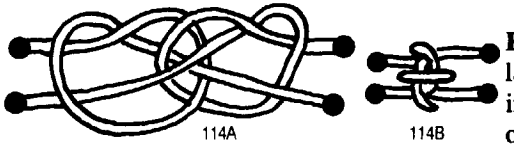
LINKED THROUGH CENTRAL SPACES

Linking the Overhands through one of the internal spaces makes a more secure knot; the simplest is to use the central space.



113. Single-Strand Riggers Knot

The **Single-Strand Riggers Knot (113)** is a decorative lanyard knot reminiscent in appearance to the Riggers Bend (128). Two Overhand Knots (58) of the same handedness are linked together as in 113A. Careful tightening will give a knot as 113B on one side, 113C on the other.

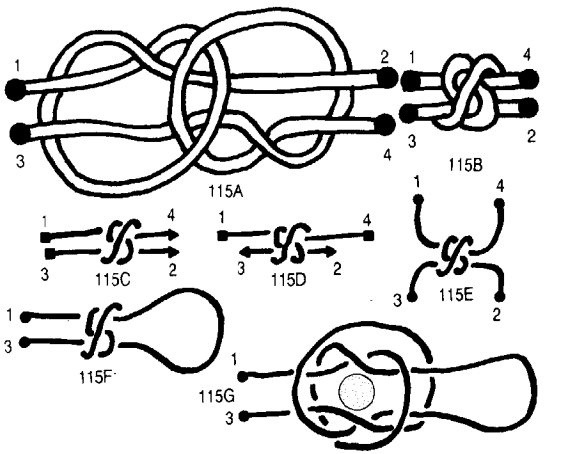


114. Japanese Lanyard Knot

The **Japanese Lanyard Knot (114)** is a two-strand lanyard knot, each strand holding an Overhand Knot (58) of opposite handedness, linked as in 114A. When tightened it shows the belly of one knot over the spine of the other (114B).

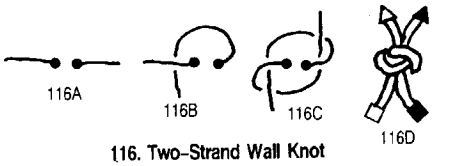
The **Two-Strand Matthew Walker Knot (115)** is a decorative and versatile formation. It can be made from two Overhand Knots (58) of the same handedness interlocked as in 115A. Work tight carefully, twisting the two pairs of cords kept together a little in the opposite way to the handedness of the knots so that it appears as 115B. Note that the cords cross over inside the knot, giving a decorative effect with cords of different colours. The **Matthew**

Walker Lanyard Knot (115C) is formed when ends 1 and 3 of 115A are standing parts, 2 and 4 running ends. The **Matthew Walker Bend (115D)** has 1 and 4 as standing parts, 2 and 4 running ends; the same arrangement may be used in a **Matthew Walker Horizontal Lanyard Knot (115E)** where the knot lies horizontally between vertical cords; the **Matthew Walker Loop (115F)** has the loop between ends 2 and 4, with 1 and 3 as ends (it does not matter which). The **Matthew Walker Bottle Knot (115G)** is tied by making the loop (115F) but, instead of pulling tight, overlap the two Overhands (115G) and place round the bottle or other object. The Overhands remain linked through the central spaces, as in the original knot (115A). This knot cannot be tied in a sling, unlike the other similar bottle knots in this book (106B, 106C, 125). This knot (115G) can also be used as a hackamore, a rope bridle, by placing the knot over the whole muzzle of the horse, or just over the nose and into the mouth, using the loop and ends as reins.



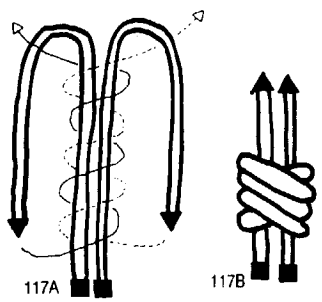
115. Two-Strand Matthew Walker Knot

Another way of tying this knot, readily generalised to higher numbers of strands, is to start looking down on the two strands as shown in 116A, where the dots represent the strands running away from you. Take the right-hand strand round and under the left-hand strand (116B), then take the left-hand strand under the running end of the right-hand strand and up through its loop (116C). If at this stage you work the knot tight, the result is a **Two-Strand Wall Knot (116D)**. If you leave 116C loose and then take each strand in turn round and up through the loop of the next strand (116E, 116F) and pull tight, you have the **Two-Strand Matthew Walker Knot (116G)** as a lanyard knot (115C). This process of taking each strand round and up through the next loop can be continued for as long as you can avoid tangles; it gives a long thin wrap around. You can follow the same sort of scheme with more than two strands: see the section on Strand Knots (Chapter 12).



116. Two-Strand Wall Knot

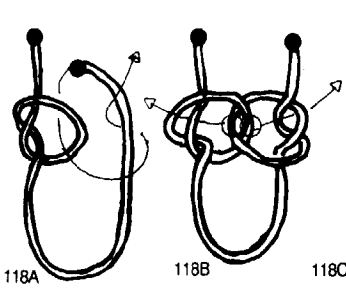
116G. Two-Strand Matthew Walker Knot



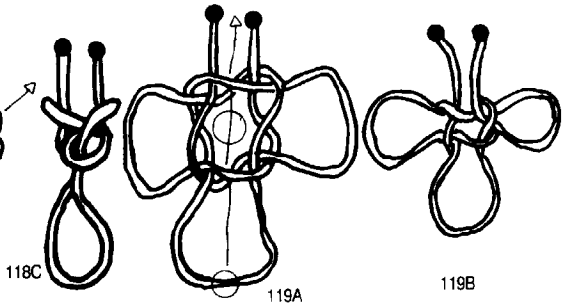
117. Two-Strand Four-Part Matthew Walker Knot

The **Two-Strand Four-Part Matthew Walker Knot (117)** is a long lanyard knot made using Double Overhand Knots (62) instead of the single knots used in 115. Follow 117A, interlaying the two strands as shown. Work tight (117B) so that the bellies of the two Overhands take up the twist. Further turns could be taken in 117A to give six or eight part knots.

The **True Lovers Knot (118** is mainly used as a decorative knot in a bight as in 118B or as a lanyard knot as in 118C. Make an Overhand Knot (58) in one cord (118A) and interlink with

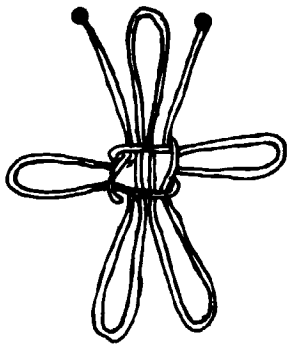


118. True Lovers Knot



119. Shamrock Knot

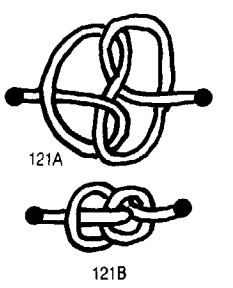
it another Overhand Knot of the same handedness as in 118B. Perhaps the most decorative form has the pairs of cords twisted at right angles (118C). If the bellies of the two Overhand Knots are passed through the spines of the opposite ones as shown by the arrows in 118B, we get a **Shamrock Knot (119)**. This can be worked tight round an object and used in a similar way to the Jury Knot (102), or pulled tight and used as a decorative knot; the ends may remain as a "stalk" or joined to form a fourth loop. If the central loop in 119B is passed through the knot as arrowed in 119A, we get a **Flower Knot (120)**. Further "petals" can be produced by repeating the operation with the side loops or as desired.


120. Flower Knot

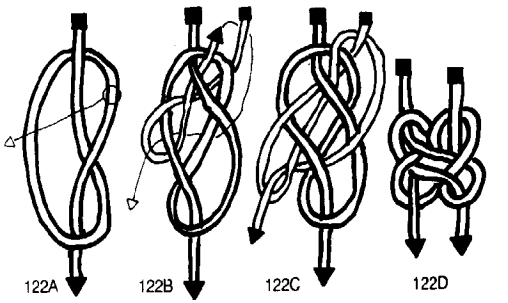
LINKED THROUGH OTHER SPACES

If the Overhands are linked through any other space, the knot tends to be more secure.

The **Conjoint Overhand Knot (121)** is a single-strand lanyard knot



121. Conjoint Overhand Knot

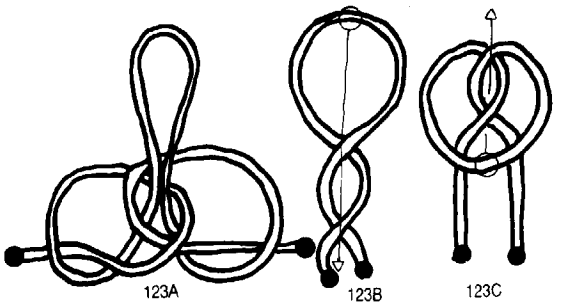


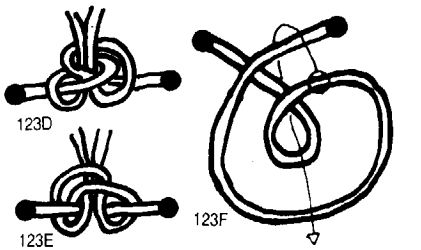
122. Flat Lanyard Knot

consisting of two Overhand Knots that share spines. Make an Overhand Knot and pass the running end into the standing space as in 121A, and work tight as in 121B.

The **Flat Lanyard Knot (122)** is formed by interlocking two Overhand Knots in the **twisted form** (twisting one element of the spine (122A) across the knot (122B)) and interweaving the second knot (122B, 122C). Work tight (122D).

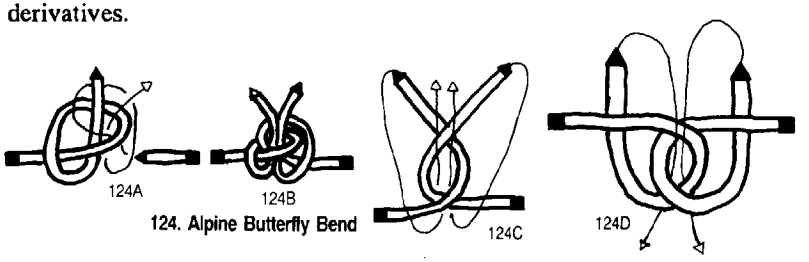
The **Alpine Butterfly Loop (123)** is one of the strongest and most secure loops in the bight of a rope. It will withstand loads between any two of the loop and the legs, as well as between all three. In structure it consists of two Overhand Knots of opposite handedness linked through the running spaces (123A), with the loop formed from the two running ends (see 124). While it can be tied direct using one end, it is much easier to tie in the bight. Take a bight and put a twist in it (123B with the upper loop the size wanted finally. Take the loop over the twist (123C) and pass it between the legs and up through the twist. The finished knot should show one standing part crossing the other on one side of the knot (123D, 123E). Alternatively, make two turns of a spiral (123F) and pass the inner turn over the knot and up through the centre as shown. This knot is becoming increasingly popular amongst users of kernmantle rope, that is, climbers, cavers and rescue workers, to fasten a karabiner to the standing part of a rope





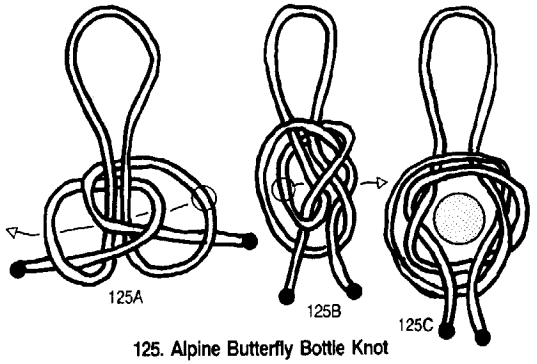
123. Alpine Butterfly Loop

for attaching to other objects. Additional applications include making etriers (135C) in climbing tape with Alpine Butterfly Loops on alternate sides at appropriate distances; in Self-Equalising Anchorages (548D); and temporarily isolating damaged sections of a rope. Some interest is being shown in some of its derivatives.



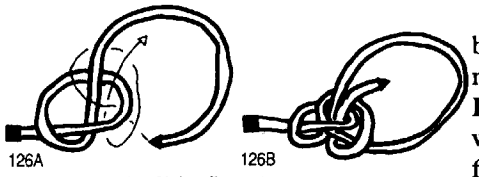
124. Alpine Butterfly Bend

The **Alpine Butterfly Bend (124)** could be expected to be an efficient bend in kernmantle because it functions precisely as in 123 with no load on the loop, though so far as I know it has not yet been tested. It can be made by tying an Overhand Knot (58) in one rope and directly linking it with an Overhand Knot of opposite handedness in the other rope (124A) or, more conveniently, by an adaptation of 123B,C. Twist the two ropes together as in 124C and pass each running end over the standing parts and up into the twist. Harry Asher has devised a standardised system for making a number of unusual bends; his start for the Alpine Butterfly Bend is shown in 124D. It can be seen to be close to 124C.



125. Alpine Butterfly Bottle Knot

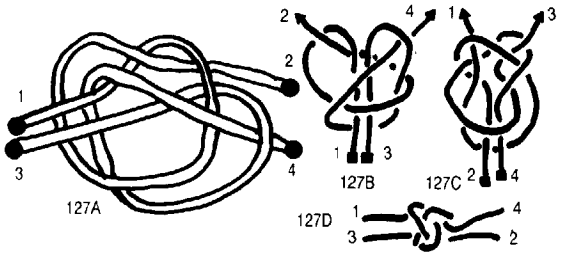
The **Alpine Butterfly Bottle Knot (125)** has the spine of each Overhand Knot passing through the central space of the other, no longer the running spaces as in 123. It can be tied in the bight; make an Alpine Butterfly Loop (123: 125A) and pass each overhand belly in turn behind the knot to the other side (125B, 125C). From the way the bellies overlap the spines, it might be anticipated that the knot might be a little more secure than 106B, 106C or 115G.



126. Alpine Butterfly End Loop

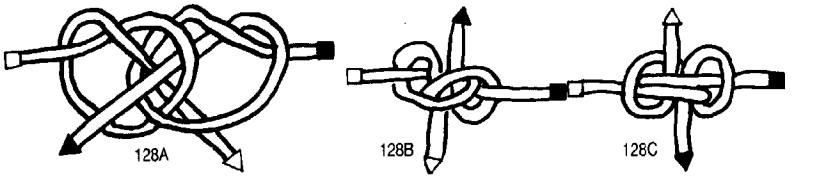
Another derivative that might be expected to work well in kernmantle rope is the **Alpine Butterfly End Loop (126)**. It can be tied in a way analogous to 124A, making the first Overhand where you want the loop to join and passing the running

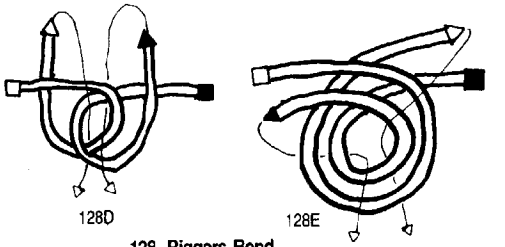
end through it as before (126A). The direction of pull in the various elements of this loop is a little different from 123, so it is uncertain without serious testing whether this knot would make a really secure end loop, but it seems to me well worth trying.



127. Two-Strand Diamond/Footrope Knot

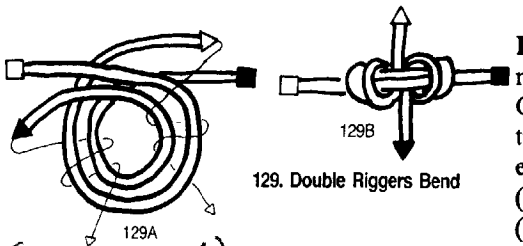
The Two-Strand Diamond/Footrope Knot (127) is a lanyard knot consisting of two Overhand Knots of the same handedness linked as shown in 127A. The Diamond Knot is merely the Footrope Knot upside down; 127B and 127C show them in forms that make tying direct a little easier. The **Diamond Knot (127B)** is formed when 1 and 3 of 127A are standing parts and 2 and 4 running ends, while the **Footrope knot (127C)** has 2 and 4 standing parts and 1 and 3 running ends. When drawn tight (127D) so that the pairs of ends are close and parallel, it can be seen that 2 and 4 are each closely bound by part of their own Overhand, whilst 1 and 3 are bound much more gently. These differences are easier to see if the two cords are of different colours. Both these knots can also be made with three or more strands (see Chapter 12).





128. Riggers Bend

The **Riggers Bend (128)** is a good bend, particularly for stiff or slippery synthetic ropes. It is formed when two Overhands of the same handedness are linked through the running spaces (128A). 128B and 128C show the two sides of the knot after working tight. Note that one of the Overhands has been twisted so that the two running ends are on opposite sides of the knot. Two other ways of making the knot are illustrated in 128D, which follows Asher's system of starting a number of unusual knots, and 128E, which is probably the simplest. In 128E start by holding the two ends parallel and overlapping and make a turn with the two ropes together (128E); they stay parallel throughout so that one running end is above the loop and the other below.



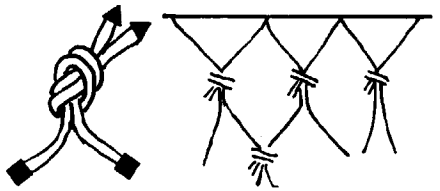
129. Double Riggers Bend

For extra security, a **Double Riggers Bend (129)** may be used, based on Double Overhands. From the parallel turns of 128E, take the running ends twice through the loop (129A); work tight carefully (129B).

(cf. zep bend)

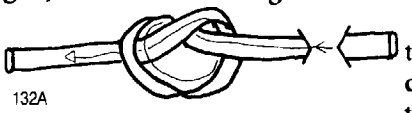
CONGRUENT OVERHANDS

The form of all these knots is as if the knot were made using doubled rope.


130A. Overhand Bend 130B. Overhand Netting

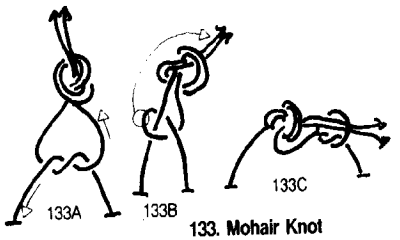
The **Overhand Bend (130A)**, made by making an Overhand Knot (58) with the two ropes together, is best regarded as a temporary join, though some mechanical binders use it and it seems satisfactory in sewing thread. When a load is placed on the two standing parts, the sharp bend of the rope at the knot weakens it and the knot may either slip out or jam tight. It can, however, be used to make a gill net of **Overhand Netting (130B)** where a series of parallel lines are joined to form a mesh. A **Collection Knot (131)** binds together a number of things such as lengths of twine, rope or grass to avoid tangles; it is more a binding knot than a bend.

131. Collection Knot


132A
132. Tape Knot

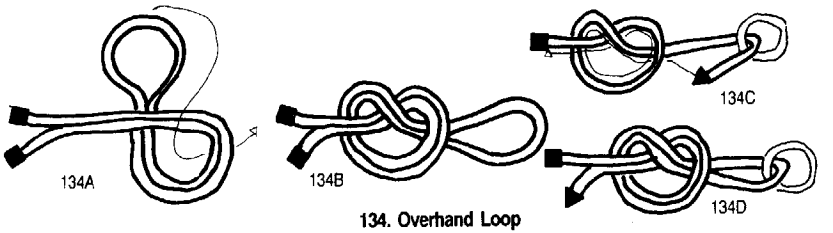
132B

The **Tape Knot (132)** is the same as the Overhand Bend (130) except that one cord has been reversed end for end. It is the best knot to join mountaineers' nylon tapes, but is also good for leather and other straps as well as cord; it used to be used in gut fishing lines but is not recommended for nylon. When tied in rope, it is sometimes known as a **Ring Knot**; with larger sizes it jams badly. Make a loose Overhand Knot in one tape (132A) and pull through the other, following all the tucks (132B). Pull tight, working the two tapes close together.


133A 133B 133C
133. Mohair Knot

Weavers using mohair, which is a slippery and springy fibre, sometimes join

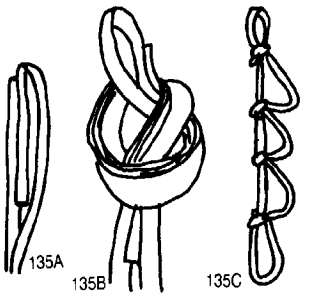
two threads with the rather bulky **Mohair Knot (133)**. Join the two ends with a Half Knot (8) and then an Overhand Bend (130), leaving the ends long (133A). Capsize (30) the Half Knot into a Half Hitch (133B) and transfer it over the Overhand Knot, and reform a Half Knot round the two ends (133C); this minimises the faults of the Overhand Bend.



134. Overhand Loop

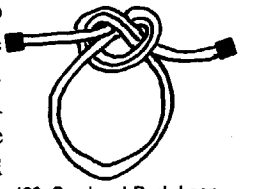
An **Overhand Loop (134)** is made (134A) when an Overhand Knot (58) is made with a bight (134B). It can be tied very quickly; when tied in natural fibres it jams very tight under a heavy load; when tied in synthetics it is not very secure. It is not recommended for a three-way pull as the knot may slide up the loop. It has been used in an emergency to protect a weak section, like a Sheepshank (364). It can be tied round an object by the **follow-through** method. Make a loose Overhand some distance back from the end, pass the running end round the object (134C) and back, then carefully follow all the turns of the Overhand (134D).

Mountaineers sometimes use short ladders called **Etriers (135C)**, sometimes made from stiff nylon tape. The most satisfactory start is the **Frost Knot (135B)**, which is an Overhand Knot tied with a bight and an end (135A); note that the running end of the bight traverses the entire knot with a substantial tail. The rungs are made by tying Overhand Knots with the doubled tape, having one side straight and the other of sufficient length to take the foot with most of the load on the first (135C).

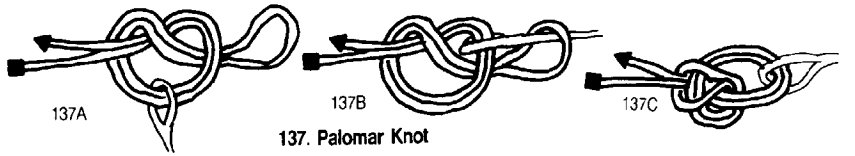


135B. Frost Knot 135C. Etriers

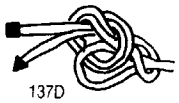
The **Overhand Back Loop (136)** is made like 134D but with the follow-through going in the opposite direction. This is a nice open loop which will withstand a good pull between the two ends (though it may well jam), and is much better for a three-way pull than the Overhand Loop (134) but should not be trusted for a pull between one end and the loop.


136. Overhand Back Loop

The **Palomar Knot (137)** is becoming popular to tie a fishing hook or swivel on to monofilament or braided nylon line. Take a bight of the line, thread it through the eye of the hook and make an Overhand Knot (58) with the doubled line over the eye (137A). Put the hook through the loop and work



137. Palomar Knot

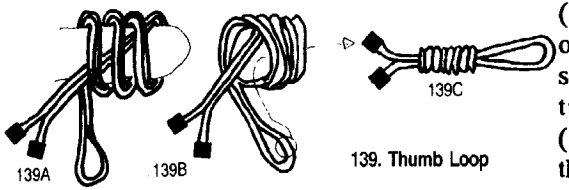


all tight with the loop hard up against the eye of the hook (137B). Some prefer to work the loop in 137B back behind the knot, forming a noose (137C) and some keep the whole knot over the shank (137D). An interesting curiosity is that 137C can be capsized into a Bowline on a Bight (437) containing the hook; it would probably still hold.

To put a loop in the end of fishing line as a leader loop, or for sea traces, or for the long game-fishing double, some find the **Double Overhand Loop (138)** satisfactory; it is of course suitable for cord. Make a Double Overhand

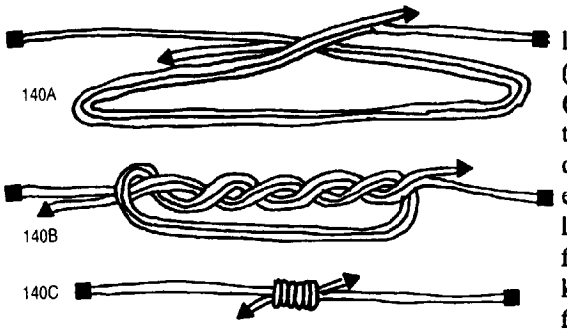
138. Double Overhand Loop

Knot (62; 138A) in the bight and pull tight (138B). However, most people prefer more turns for fishing line. A way of tying a Multiple Overhand Knot in difficult conditions is to wrap a bight over its standing part on the thumb (139A) the desired number of turns (probably five or six). Carefully remove the turns from your thumb (139B) and pass the bight through the turns as shown, and work tight (139C).



139. Thumb Loop

This is called a **Thumb Loop (139)**.



140. Water Bend

The multiple turn analogue of the Tape Knot (132) is the **Water Bend (140)**. This is mainly used to join fishing lines. A double turn knot is adequate for gut lines, but at least four turns are needed for nylon. In principle, the knot could be tied by the follow-through method described for the Tape Knot, but this is very fussy with fine lines. Provided one line is reasonably

short or is in a small coil, it is easier to tie the knot by overlapping the ends and forming a loop (140A). Pass the short standing part and the other running end through the loop the desired number of turns (140B) and pull tight (140C).

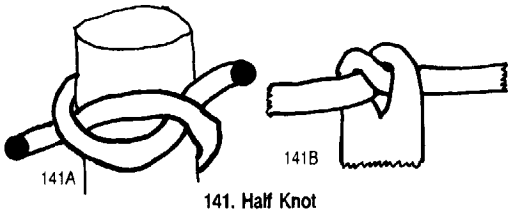
Chapter 10
HALF KNOTS

Typically, these knots are formed from an Overhand Knot tied around an object, such as a parcel or spar.

SIMPLE HALF KNOTS

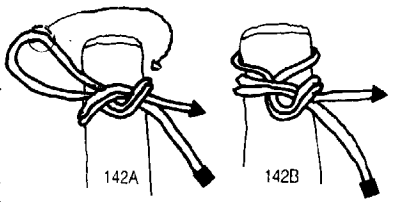
A half knot by itself is rarely secure; some means have to be adopted to hold it in place. The simplest are discussed in this section.

A Half Knot (141) is a quick crossing knot (141A; see also 89A) and is an adequate binding knot if made in rough cord round a rough object. It is also used (141B) to tie together the two tails of a bandage or other tape or ribbon that has been split for tying off (no safety pins!).



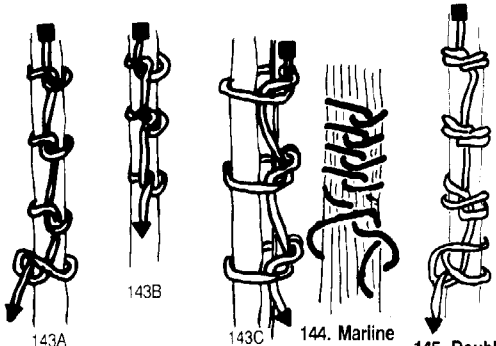
141. Half Knot

If the mooring post is suitable, a good mooring is the **Overhand Mooring Hitch (142)**. Make a Half Knot (141) using a bight of the rope round the post (142A) and pass the loop over the post (142B). Do not work it too tight or allow it to fall too far down from the top of the post or you will find it hard to remove; in difficult circumstances it may be a help to first work the running end out of the knot.



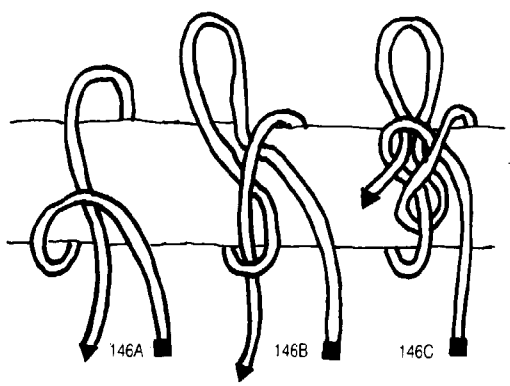
142. Overhand Mooring Hitch

Marline Hitches (143) hold together parallel bundles of rope, twine, light spars or wrapped bundles, or tie sails to gaffs or booms, or fasten wire bolt ropes to large sails, or fasten the walls of a heavy tent to the uprights (143C). To tie, make a small Underhand Turn and take the rope round the object and



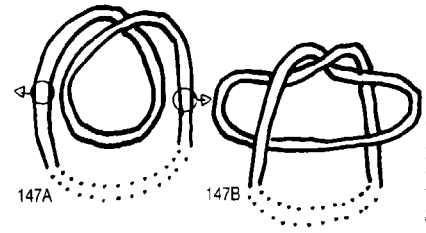
143. Marline Hitch

through the turn (143A); capsize the turn as you pull tight to form a Half Knot. If you are passing each hitch through an eyelet (143C) it is easier to tie the knots direct. Do not confuse Marline Hitches with simple Half Hitches (143B). A decorative way of binding together a number of cords is the **Marline Binding (144)**, particularly attractive in leather thongs. Taking each left-hand cord in turn, tie a Marline Hitch (143) round all cords. If a load is to be placed on each individual cord it is important that each cord be used for knotting, but otherwise it does not matter much as long as several cords are involved. The **Double Marline Hitch (145)** is more secure and will withstand wear better than a Marline Hitch (143); if one turn breaks the rest will remain fairly tight for quite a while. It is easiest to tie like the Marline Hitch (143A), taking the cord twice through the turn (145) and capsizing.



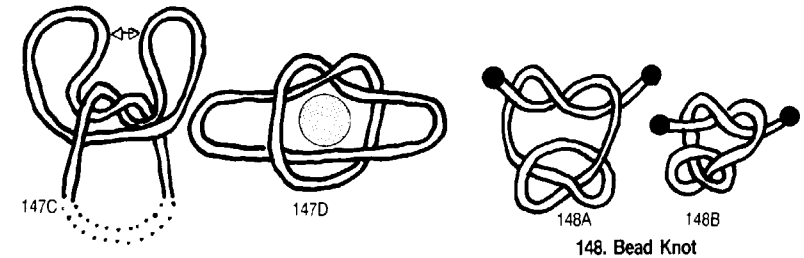
146. Donkey Hitch

The **Donkey Hitch (146)** can be used as a slip hitch to tie an animal to a rail, or as a loose slip binding knot to, for example, fasten the brailings round the furled wall or door of a tent. It does not hold as well as a Reef Knot or Slip Reef but is easier to remove. Make a Half Knot (141) round the object using a bight of the standing part (146A); take a bight of the running end through this bight (146B) and tighten by pulling the standing part against the bight of the running end (146C).



147. Overhand Sling Knot

The **Overhand Sling Knot (147)** can be used as a quick means of shortening a sling (147C) or for forming a not very secure bottle knot (147D). Form a turn (147A) and draw the two sides of the turn beyond the standing parts (147B). These two bights are then taken up to the hook to shorten the



147. Overhand Sling Knot

148. Bead Knot

sling (147C) or tightened round the neck of the bottle (147D).

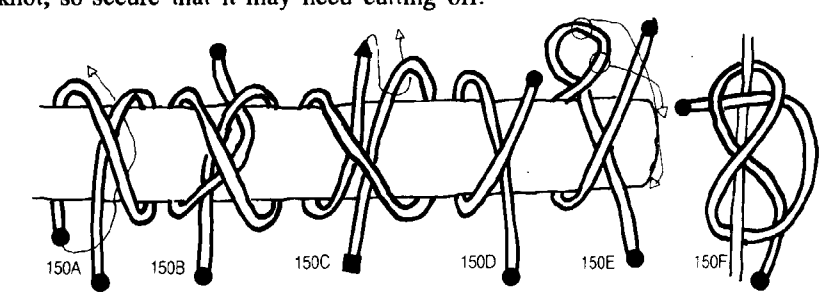
The **Bead Knot (148)** is used to make a large though inelegant stopper knot in a light line, such as the thread of a necklace. Make an Overhand Knot and then a Half Knot of the same handedness around the belly (148A). When tightened (148B) the Overhand Knot presents a considerable obstacle.

The **Surgeons Half Knot (149)** by itself is used in stainless steel sutures; the stiffness of the steel holds the twists in place.

149. Surgeons Half Knot

ENTRAPPED HALF KNOTS

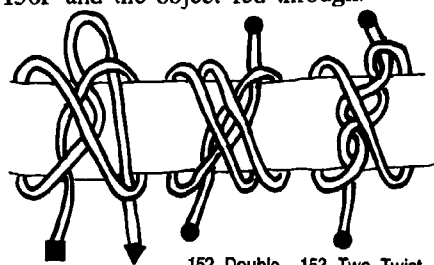
The Constrictor and Strangle Knots and their variants contain a Half Knot round an object that is hidden or covered by a turn of the belly of the knot, which traps and secures the twist of the Half Knot. Each is a secure binding knot, so secure that it may need cutting off.



150. Constrictor Knot

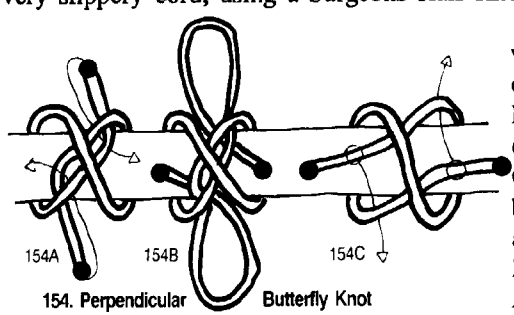
The most secure is the **Constrictor Knot (150)**; it is excellent for binding bags or sacks, as a most secure crossing knot, as a ligature in surgery, as an emergency whipping or even hose clamp. It can be tied direct by making a Riding Turn (150A) and passing the running end over the standing part and under the belly and standing part as shown in 150B. It can be made from a Clove Hitch (372) by tucking the running end under the first turn of the standing part as shown (150C). If the cord is long and the end of the object free, it may be tied in the bight by making a riding turn (150D), lifting and twisting

the first turn (150E) and passing the bight between the ends and over the object as indicated in 150E. For small cordage, the knot may be preformed as 150F and the object fed through.



151. Slip Constrictor 152. Double Constrictor 153. Two-Twist Constrictor

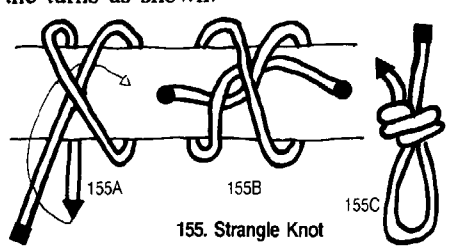
Because the Constrictor Knot jams so tight, it may be worth tying a **Slip Constrictor (151)**; note that it is more secure to include the last two tucks in the slip. A wider and more secure knot is the **Double Constrictor (152)** or even Triple or Quadruple Constrictors. These are best for whippings or seizings; they might well last as long as short Common Whippings (12). The **Two-Twist Constrictor (153)** shows a way of getting better security with very slippery cord, using a Surgeons Half Knot (149) entrapped by its belly.



154A 154B 154C

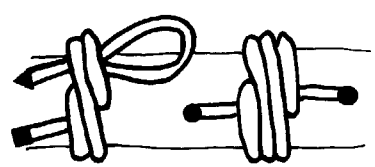
154. Perpendicular Butterfly Knot

A decorative binding knot with two loops sticking out either side of an object is the **Perpendicular Butterfly Knot (154)**. This can be tied from a Constrictor Knot by slipping both ends back under the turns as shown (154A), twisting the loops to centre them (154B). Alternatively, start from 154C and slip twisted bights under the turns as shown.



155A 155B 155C

155. Strangle Knot

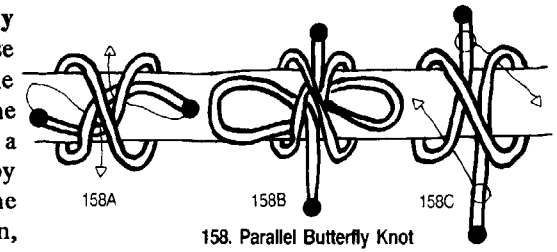


156. Slip Strangle Knot 157. Double Strangle Knot

The similar **Strangle Knot (155)** has the ends parallel to the object being bound and is more decorative than the Constrictor Knot (150) though a little less secure, specially over an uneven surface. It is tied by making a riding turn with the running end coming between the standing part and the turn (155A); take the running end over the standing part and under the two turns (155B). A **Strangle Noose** is formed when a Strangle Knot is tied round the standing part (155C); once tightened, this will not loosen easily. A **Slip Strangle Knot (156)** and a **Double Strangle Knot (157)** are tied in similar ways to the corresponding Constrictor Knots. Note that a Strangle Knot is actually a Double

Overhand Knot (62) in the Grapevine form tied round a core. The Double Strangle Knot is a Triple Overhand Knot round a core.

The **Parallel Butterfly Knot (158B)** can likewise be formed from the Strangle Knot (158A) by passing the ends as shown, or from a Clove Hitch (372: 158C) by passing bights under the adjacent turns as shown, arranging for the ends to be close to the central turn.



158A 158B 158C

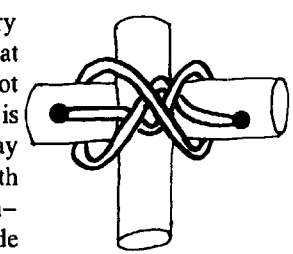
158. Parallel Butterfly Knot

159A 159B

159. Twin Loops Knot

The **Twin Loops Knot (159)** forms a decorative pair of loops which can be used for such purposes as holding back curtains and the like; ornamental stopper knots or tassels on the ends could help the effect. The knot is tied by making a multiple Strangle Knot over a bight of the cord (159A) and working tight with equal loops (159B).

The **Transom Knot (160)** is used as a temporary lashing, binding together two spars etc that cross at right angles. The knot is simply a Strangle Knot spread out to cover the two spars. If the cord used is small in diameter compared to the spars, you may need a Double or a Multiple Strangle Knot for both security and strength. Greater security can be obtained by tying a second Strangle Knot on the other side of the crossed spars, with bights round the other spar to the first knot.

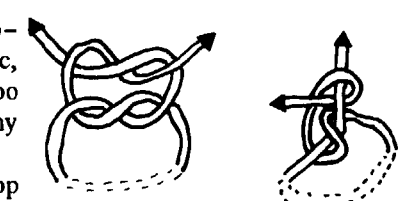


160. Transom Knot

PAIRED HALF KNOTS

This section contains the knot that is probably the best-known to the general public, the Reef Knot, and the knot that is too often tied for it in mistake, the Granny Knot.

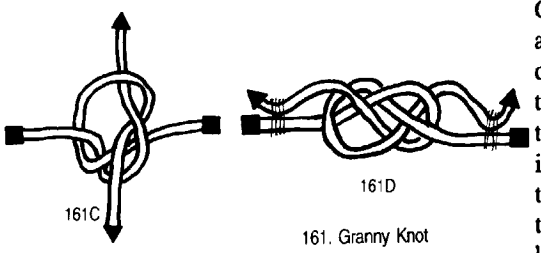
Two Half Knots can be tied one on top of the other. The **Granny Knot (161)** has the Half Knots of the same handedness,



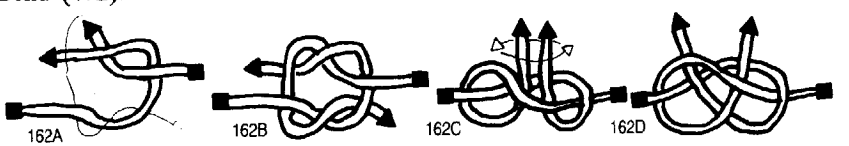
161A 161B

161. Granny Knot

and is insecure whether as a bend or as a binding knot. Surgeons sometimes take advantage of this insecurity by tying their sutures with a Granny Knot, then carefully adjusting the tension before clinching the knot by tying a Half Knot of opposite handedness on top. The knot capsizes as shown to Two Half Hitches (161B); occasionally it is convenient to tie the latter by way of the Granny. A Granny Knot can also be used to change direction at a crossover when tying parcels etc (161C). If the upper Half Knot of 161A is twisted round the lower, the form 161D can be obtained. This is one of the knots known as a **Single Carrick Bend (161D)**. The knot has been used, with the running ends seized strongly and securely, to bend wire ropes and natural fibre large diameter hawsers and cables. It has neither the flexibility nor the security of the Carrick Bend (472).

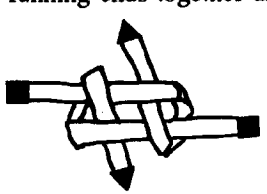


161. Granny Knot



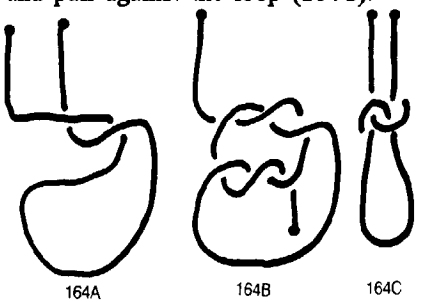
162. Thief Granny Knot

The **Thief Granny Knot (162)** has the same formation but with the running ends on opposite side of the knot. It can be tied by making a bight in one rope (162A), and twisting the other running end with the first and then with the standing part (162B). It slips when the standing parts are pulled, and capsizes, into one or other of a wide variety of forms; a couple of minutes playing produced eight different forms, and I am sure there are more. Nearly all forms slip very freely, but one, 162D, grips quite well. This form can be produced from 162C, which is formed quite frequently, by twisting the two running ends together as shown. The 162D form has been called the **Whatnot** or **Jinx**. The **Grass Knot (163)** will hold in any stiff flat fibre, such as a leather strap or grass; depending on flexibility, loading may make it slip a little and capsize to the form 162D and then hold. The knot also works well in wire; if made in cord you need to make sure that other forms are avoided. Although it is one of the forms into which the Thief Granny can capsize it is best tied direct, being careful to cross the ends as shown.


163. Grass Knot

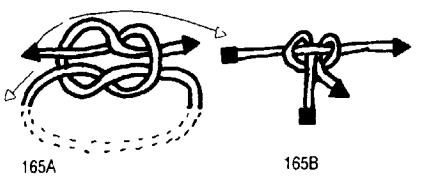
The **Oblique Granny Loop (164)** is a decorative loop with the ends leading out parallel, best kept for occasions where any load is on both ends, as in a lanyard knot. Make a Thief Granny (164A, 164B) with a bight of the

desired size; work fairly tight without capsizing, bring the two ends together and pull against the loop (164C).

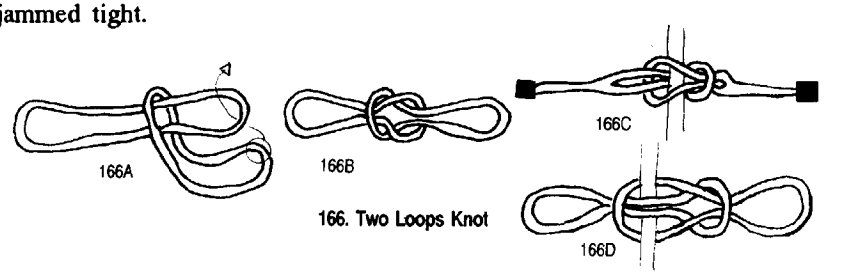


164. Oblique Granny Loop

The **Reef Knot (165A)** has a Half Knot on top of another of opposite handedness. It is used to join the two ends of a rope tight round an object. It gets its name from the reef points of a sail, and is still used in non-mechanised sailing. Its main use ashore is in bandaging, as it is a soft and flat knot, and in tying up parcels etc. It should not be used as a bend, joining two ropes that have to stand free; it slips easily and can capsize (165B) to a Bucket Hitch; this capsizing can sometimes be used to untie a Reef Knot that has jammed tight.



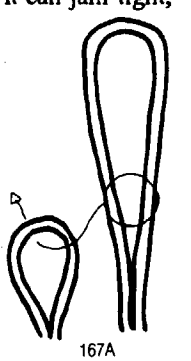
165. Reef Knot



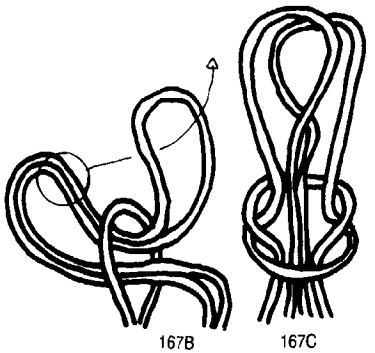
166. Two Loops Knot

A knot to join two slings or snotters that has the same formation as the Reef Knot is the **Two Loops Knot (166)**. Like the Reef Knot, it can jam tight, but it cannot capsize because the pull is on all four legs and is therefore quite secure. It is tied by placing one loop over the other (166A) and drawing the whole of one loop through the other (166B). The jamming problem can be avoided by making the knot in the **Toggled** (166C) or **Slip Toggled** (166D) form; note that if the toggle falls out, the first reverts to the ordinary form but the second spills completely.

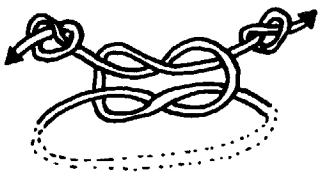
Some bottle knots (e.g., Fishermans Bottle Knot, 106; Overhand Sling Knot, 147) can be tied in slings; others can have the ends spliced to form loops. The handle loops can then be knotted into the **Loop Handle Knot (167)** as a convenient way to keep the handles together. Arrange the bottle knot to have one loop much longer than the other (167A). Pass



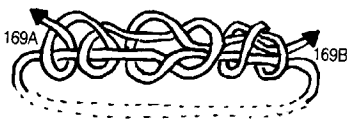
167. Loop Handle Knot



167. Loop Handle Knot



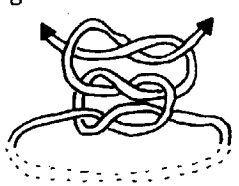
168. Stopped Reef Knot



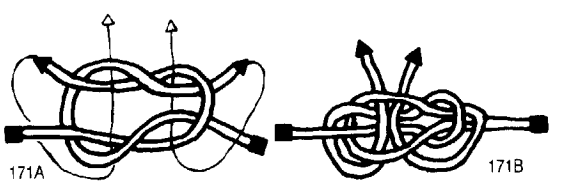
169. Secured Reef Knot

a bight of the paired cords of the longer loop through the smaller (167B) and then through its own loop (167C); the result is a Two Loops Knot (166) round the standing parts of the longer loop.

When used as a binding knot, the Reef Knot (165) cannot always be tied really tight and becomes insecure specially if subjected to a give and take motion. As already stated, a Reef Knot is dangerously insecure as a bend. Security in either of these circumstances can be increased by modifying the knot. The **Stopped Reef Knot (168)** has an Overhand Knot tied in each running end close up to the knot. This has also been suggested as a secure bend for joining tapered textiles such as sheets or handkerchiefs, including the traditional knotted sheets to escape from a bedroom in a fire. The **Secured Reef Knot (169)** has the running ends secured to the adjacent standing parts with one or two Half Hitches or a single or Double Overhand Knot, examples being shown in 169A and 169B.



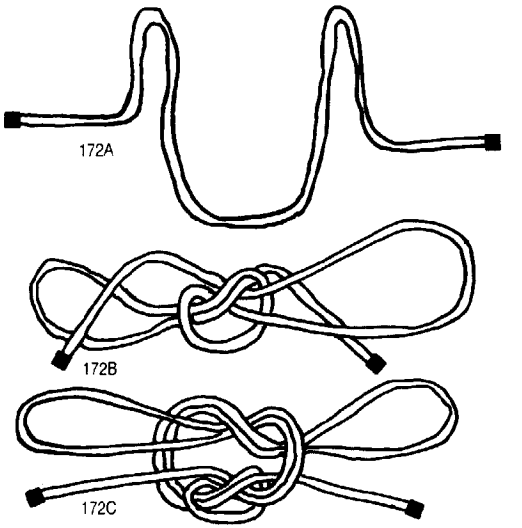
170. Clinched Reef Knot



171. Tucked Reef Knot

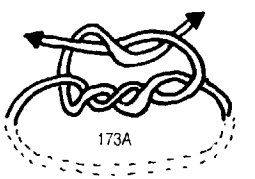
The common practice of tying one or two extra Half Knots on top of a Reef Knot to make a **Clinched Reef Knot (170)** results in bad jamming but there is some extra security. A **Tucked Reef Knot (171)**, which has the two running ends (171A) passed between the two loops of the Reef Knot (171B) is more secure as a bend but cannot be made tight as a binding knot; it jams badly, but could be slipped.

A secure though not jam-proof of shortening a rope, applicable to a bight when the ends are unavailable or to a sling, is the **Reef Shortening (172)**. Take two bights of the same size in the middle of the rope (172A) and use them to make a Half Knot (172B) and complete the Reef Knot (172C). The loops may get in the way in some applications.

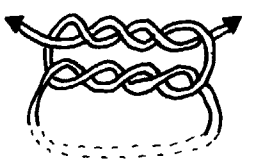


172. Reef Shortening

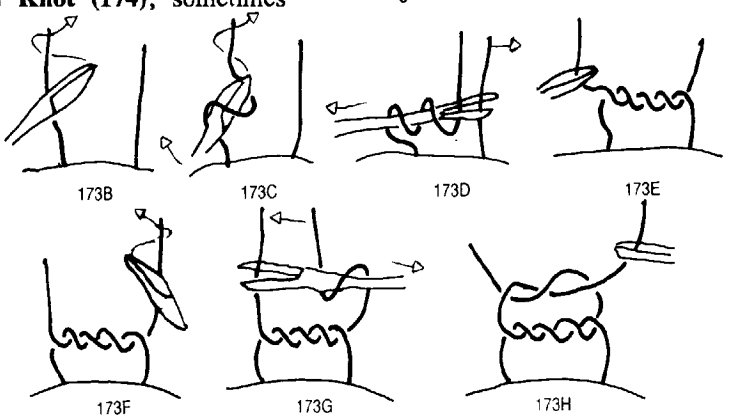
The **Surgeons Knot (173)** gives more security than a Reef Knot (165) as a binding knot used in suturing or when using slippery cordage; the extra twists prevent the knot loosening while being tied. Start with a Surgeons Half Knot (149) and complete with an ordinary Half Knot of opposite handedness to give a Surgeons Knot (173), or with another Surgeons Half Knot to give a **Double Surgeons Knot (174)**; sometimes



173. Surgeons Knot

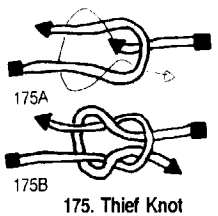


174. Double Surgeons Knot

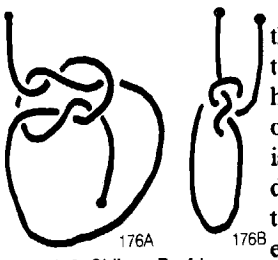


173. Surgeons Knot

the first half knot may have three twists. To tie a Surgeons Knot with forceps, place two twists in the first running end (173B–D) and withdraw the other through the twists (173D,E), then repeat the action (173F,G) as needed.



175. Thief Knot

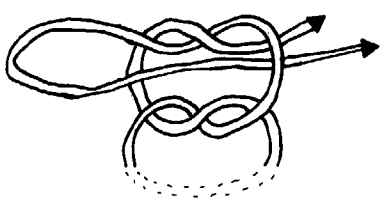


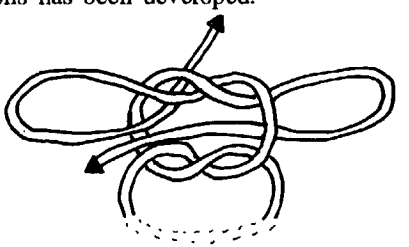
176. Oblique Reef Loop

The **Thief Knot (175)** is like the Reef Knot (165) in having two Half Knots of opposite handedness, but the running ends on opposite sides of the knot. It is alleged that it was invented to detect if a bundle had been interfered with—any thief was expected to retie an opened bundle with the orthodox Reef. Tie it by making a bight with one end (175A) and follow the arrows with the other end (175B). It is very insecure but can be made into an **Oblique Reef Loop (176)**, a decorative loop for a lanyard knot, tied by making a Thief Knot with a bight of the required size (176A), bringing the two ends together and pulling them against the loop (176B).

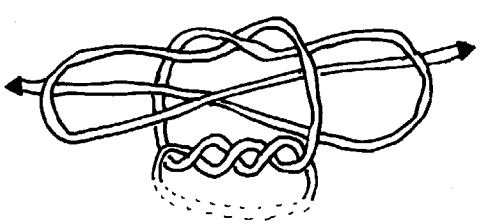
SLIPPED REEF KNOTS

The reef knot is very convenient for many purposes, but it does tend to jam, so that a whole variety of slip versions has been developed.

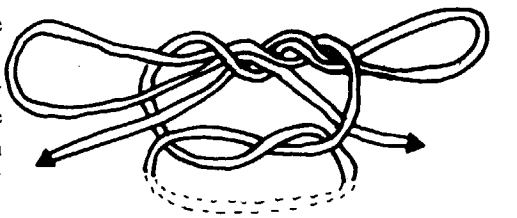

177. Slip Reef Knot

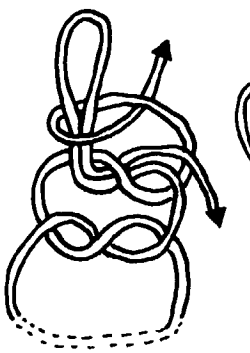

178. Reef Bow

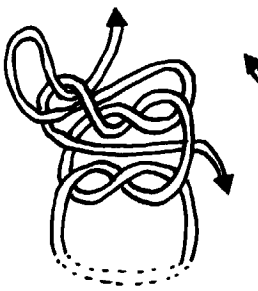
Quick release versions of the Reef Knot (165) are the **Slip Reef Knot (177)** and the **Reef Bow (178)**, or of the Surgeons Knot (173) the **Surgeons Bow (179)**, tied by making the second Half Knots using one or two bights instead of the running ends. The Bows are decorative and are often used to tie up shoelaces or parcels. Connoisseurs may attempt to tie an Upset Slippery Thieving Surgeons Granny! More secure than the Reef Bow (178) is the **Shoelace Knot (180)**; after making the first Half Knot, use the bights to make a Surgeons Half Knot (149), taking one turn with each bight; if the laces are rough the grip is strong and it is better to wrap one bight round the other rather than twisting them.

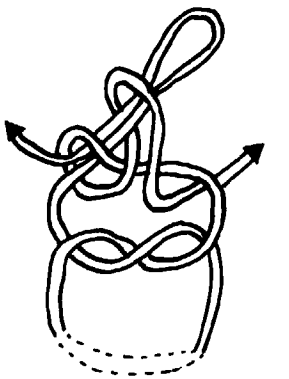

179. Surgeons Bow

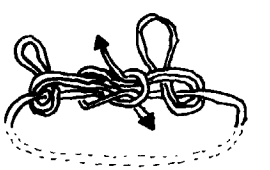
The slipped Reef Knots are used with several sorts of clothing, not only shoes, and in parcels or the like where they are subject to frequent contact with other objects, which can easily slip the knots or, what is sometimes worse, pull out the bights and allow the knots to jam tight. There are several knots that are intended to prevent this; three of those shown here (181–183) retain the quick release property but add extra friction; the others add hitches or the like that are usually easy to remove. The **Stationers Knot (181)** is formed from a Slip Reef (177) by casting a Half Hitch in the free running end over the bight of the other. The **Parcel Knot (182)** is also formed from a Slip Reef by passing a bight of the free running end through the bight of the other and pulling tight. The **Shoestring Knot (183)** starts with a Reef Bow (178), passing one bight through the other and pulling tight. Perhaps the most secure is the **Secured Reef Bow (184)**, tied as 169 using the bights of the Reef Bow (178), and one of the easiest to tie, though not so secure, is the **Clinched Reef Bow (185)**, tied as 170 using the bights of the Reef Bow (178).

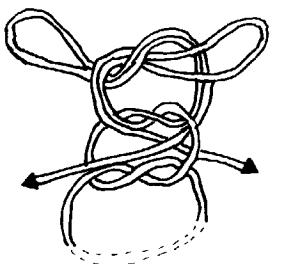

180. Shoelace Knot


181. Stationers Knot


182. Parcel Knot

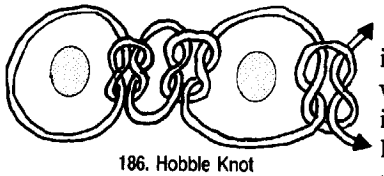

183. Shoestring Knot


184. Secured Reef Bow


185. Clinched Reef Bow

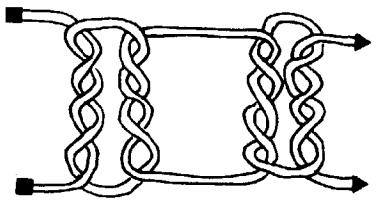
MULTIPLE HALF KNOTS

Nearly all the knots in this section are decorative; this may be enhanced if the cords are of different colours.



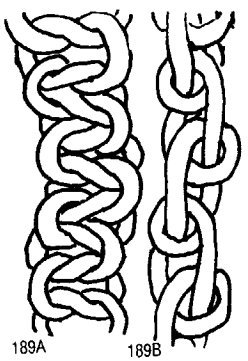
186. Hobble Knot

187. Reef Lanyard



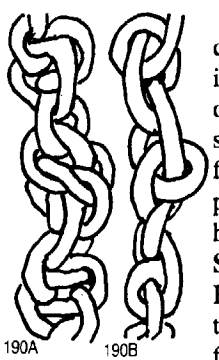
188. Surgeons Lanyard

Several Reef Knots (165) may be used in series to make a **Hobble Knot (186)**, where the animal's two legs are placed as indicated and bound as shown with Reef Knots at an appropriate distance apart; it is more comfortable if the ropes on each side of the leg make a round turn, and this is recommended for use with people in a three-legged race. Or several Reef Knots may be used to make a **Reef Lanyard (187)**, which may be used as a decorative two-strand lanyard knot or, in suitable rope, as an all-rope ladder, as may a **Surgeons Lanyard (188)**. For use as ladders, these knots need to be spaced correctly and started with Half Knots of alternating handedness and pulled very tight.



189A 189B

189. Solomon Sennit

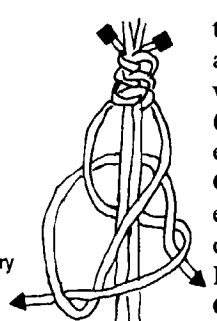


190A 190B

190. Bannister Sennit

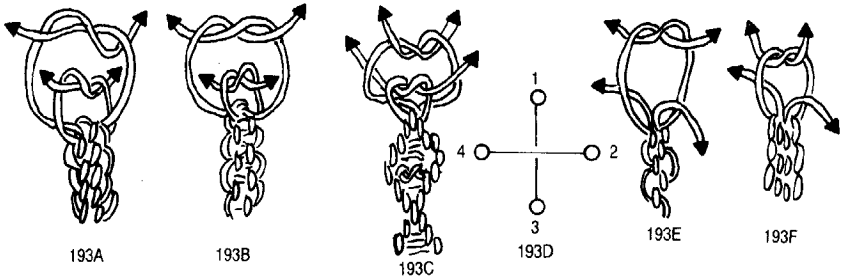
The **Solomon Sennit (189)** consists of Half Knots of alternating handedness made one on top of the other; it makes a good flat sennit, specially if made in soft flexible cord. If all the superimposed Half Knots are of the same handedness you get a **Bannister Sennit (190)** with a marked spiral. Both these knots, if not made too tightly, may be capsized to the forms 189B, 190B, resembling the Chain Bar (388).

191. West Country Sennit



192. Thief West Country Sennit

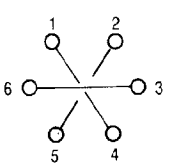
Attractive sennits can also be made by tying Half Knots alternately on either side of a core, which may be two cords similar to the working cords. The **West Country Sennit (191)** uses Half Knots all of the same handedness, in a similar configuration to the West Country Whipping (13) and may be considered as making Granny Knots (161) round the core. If you make Reef Knots (165) or Thief Knots (175) around the core instead of Granny Knots, the appearance of the sennits is not very different, but if you make a Thief Granny Knot (162) to make a **Thief West Country Sennit (192)**, tying the knots as indicated, the appearance is very different. Surgeons Half Knots (149) round a somewhat larger core are also worth experimenting with. Any of these pairs of Half Knots round a core may be used in arrangements similar to macramé work, though the Thief and, particularly, the Thief Granny are not very secure.



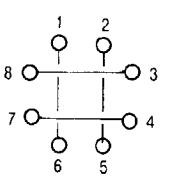
193A 193B 193C 193D 193E 193F

193. Four-Strand Overhand Sennit

Another family of sennits based on Half Knots forms soft and springy round sennits; they may be used as fenders if made of appropriate rope. The **Four-Strand Overhand Sennit (193)** is made by tying a Half Knot with strands 1 and 3 (193D) and covering it with a Half Knot of strands 2 and 4 and repeating. If all the Half Knots are of the same handedness, you get a round sennit with a pattern spiralling up it (193A). If you make two right-handed Half Knots followed by two left-handed ones and so on, each pair of strands making repeated Reef Knots, the pattern goes straight up (193B). If all the Half Knots in one pair of strands are right-handed and all those of the other are left-handed you get an unusual sennit with two spirals of opposite handedness (193C). Care needs to be taken where the spirals cross. Other patterns can be obtained with other alternations of handedness. If the Half Knots are made only with, say, strands 1 and 3, with strands 2 and 4 being simply folded across the sennit, you get a somewhat flatter sennit. Again you get a different pattern depending on whether the Half Knots are of the same (193F) or alternating (193E) handedness.



194. Six-Strand Overhand Sennit

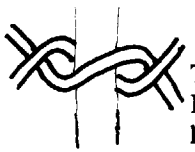


195. Eight-Strand Overhand Sennit

A Six-Strand Overhand Sennit (194) is made similarly, tying Half Knots across the sennit with strands 1 and 4, 2 and 5, 3 and 6. Again, handedness may vary in different patterns and one or two pairs of strands may be folded. It is more usual, and more stable, to make an **Eight-Strand Overhand Sennit (195)** by making parallel Half Knots across the sennit with strands 1 and 6, and 2 and 5, and then cross them with strands 4 and 7, and 3 and 8, again alternating handedness or using folds as desired. Thus a wide variety of sennits may be obtained by simple variations;

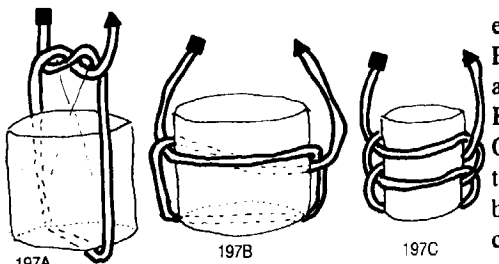
the variety is more obvious if the strands are of different colours. The use of Surgeons Half Knots (149) instead of Half Knots in these sennits would give similar external appearances but a more springy consistency.

OPENED-UP OVERHANDS



196. Opened-up Overhand

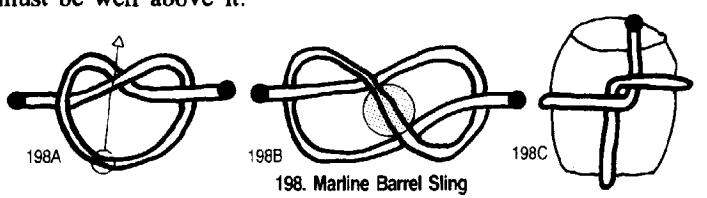
This last section of knots based on the Overhand or Half Knot looks at what happens when the spinal twists of the knots are opened up **(196)** and something passed down through the opening.



197A 197B 197C

197. Barrel Sling

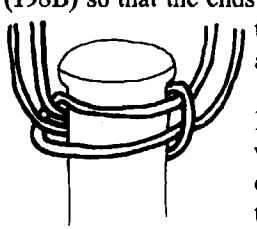
To raise a barrel or drum on end, tie a **Barrel Sling (197)**. Pass the rope under the barrel and centre it. Make an Overhand Knot above the barrel (197A). Open out the Overhand and work the parts down the sides of the barrel, keeping it well above the centre of gravity (197B). Depending on the application, the ends may then be joined with a Bowline or otherwise to ensure that the barrel is lifted on the level. For slippery objects, or greater security, repeat the process from 197A to make a **Double Barrel Sling (197C)**. If the drum is near full, the lower turn may be a little below the centre of gravity, but the upper must be well above it.



198A 198B 198C

198. Marline Barrel Sling

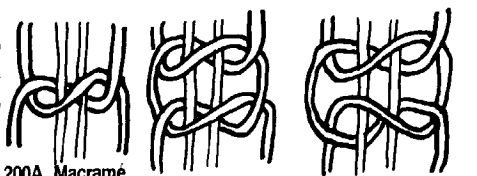
A more secure barrel sling is the **Marline Barrel Sling (198)** which has Marline Hitches (143) in place of the Single Hitches of 197. To tie it, make an Overhand Knot in the middle of the rope (198A) and twist it open and flat (198B) so that the ends are above the turns. Place the barrel over the centre of the knot and work the ends and turns up until the turns are above the centre of gravity (198C).



199. Pipe Sling

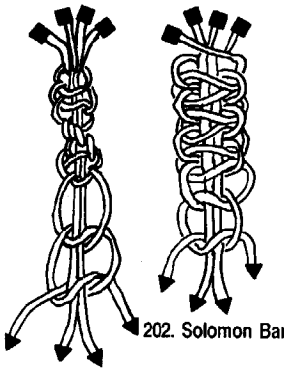
The **Pipe Sling (199)** is in effect a Two Loops Knot (166) opened up. It is used to lift vertically a pipe with a good lip. Use two slings of equal length; place one round the pipe and pass the other through it, round the other side of the pipe and pass the first sling through its bight.

The remaining knots in this section are all decorative knots based on repeated **Macramé Knots (200A)**, Overhand Knots opened up round a core, usually of two cords similar to the working cords. The Macramé Knots are usually tied by passing one strand over the core and down behind the second strand, which then passes behind the core and down in between the core and the first strand. Two consecutive Macramé Knots of the same handedness (a Granny Knot opened up) form a **Twisted Knot (200B)**; two of alternate handedness form a **Flat Knot (200C)**, an opened-up Reef Knot. There seems to be a big variety of names for the various combinations of these knots.



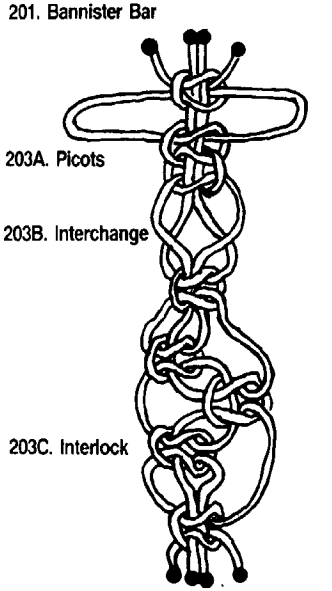
200A. Macramé Knot 200B. Twisted Knot 200C. Flat Knot

The **Bannister Bar (201)** consists of repeated Twisted Knots (200B) all of the one handedness; when worked tight the sennit spirals with a handedness opposite to that in the Macramé Knots. An interesting effect is to change the handedness after every few knots. The **Solomon Bar (202)** has repeated Flat Knots (200C). A few of the effects of manipulating these knots, collectively known as **Square Knotting (203)**, a part of Macramé (which also contains knots based on Single Hitches as described in Chapter 16) include Picots, Interchanges and Interlocks. **Picots (203A)** are loops of the working cords when the Flat Knots are kept separate; single-strand lanyard knots may be tied in the Picots or single-strand lanyard knots in the individual cords of the core, or in the two together, or two-strand lanyard knots between the two. The core and working cords can **Interchange (203B)**, particularly effective if of different colours. The Flat Knots may be tied over a single core cord and an **Interlock (203C)** formed by alternating which cord is spare. Many other variations are possible.



202. Solomon Bar

201. Bannister Bar

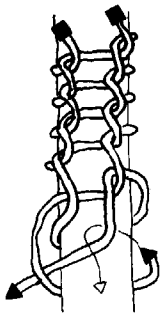


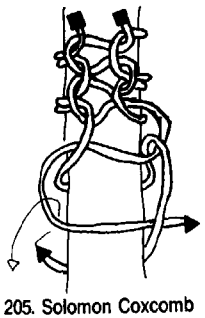
203A. Picots

203B. Interchange

203C. Interlock

203. Square Knotting


204. Bannister Coxcomb

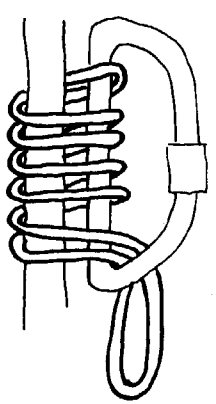

205. Solomon Coxcomb

The same knots can be tied round a rigid core such as a spar. The **Bannister Coxcomb (204)** can have the turns worked close together as a ridge along the middle of the core. If they are worked tight they form a spiral as in the Bannister Bar (201) but if slackened a trifle they can be held straight. A **Solomon Coxcomb (205)** uses Flat Knots (200C), with the interlocks close together; another form has them diametrically opposed.

Chapter 11
FRICTION OVER LONG LENGTHS

The remaining knots in Part 2 involve, not so much twists as long lengths of cord held in close contact by some means to provide friction.

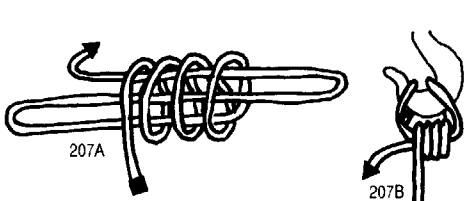
MULTIPLE TURNS


206. Bachmann Knot

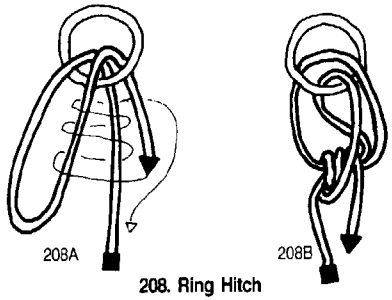
The long lengths in the many turns provide friction, not in this Chapter obviously related to Overhands or Figure Eights.

The **Bachmann Knot (206)** is used by cavers and climbers to support their weight on a sling attached to a vertical rope; it is easy to slide the knot up or down when unladen. The knot is particularly suitable for wet or icy ropes; note that if all load is removed it can slip very readily, perhaps out of reach. The sling should be not much more than half the diameter of the climbing rope; clip it into the karabiner and then wrap around the rope and karabiner, the number of turns depending on the circumstances.

The **Catspaw on the Running End (207)** fastens a hook to the running end of a rope. Make a long S-bend and roll it up along the standing part at least four times (207A); the two bights pass over the hook (207B). The identical formation, with the pull on the other end, is found in the

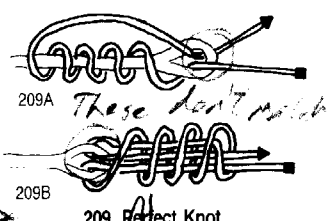


207. Catspaw on the Running End



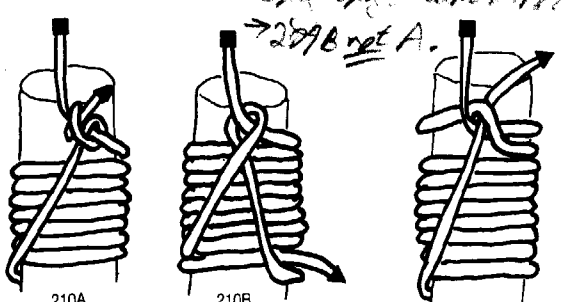
208. Ring Hitch

Ring Hitch (208). This fastens a rope to a ring or other object with ends unavailable, with two bearing ropes but only one pass; it is useful in towing. Pass a bight through the ring and then take the running end round the running end leg of the bight and the main standing part for two or three turns (208A). Even up the knot to get the wrap around perpendicular to the standing part (208B) and secure the running end to the standing part with a Bowline or the like.



209. Perfect Knot

The **Perfect Knot (209)** fastens a nylon fishing line to the eye of a swivel or the like. Pass the line through the eye, take about five loose turns around the swivel, and return through the eye in the opposite direction (209A). Move the turns back over the eye and standing part, keeping them in the reverse order (209B).



210. Lifting Hitch

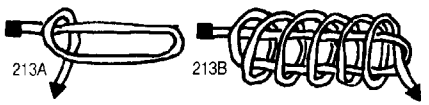
211. Pipe Hitch

The **Lifting Hitch (210)** attaches a rope to a spar or pipe for lifting on end. A number of turns, usually six to ten or perhaps more for synthetic ropes, are taken round the spar and the running end taken back over the turns to secure to the standing part either two Half Hitches (210A) or with one Half Hitch round the standing part followed by one or two Single Hitches around the spar below all turns (210B). The **Pipe Hitch (211)** is a similar knot for lifting smooth cylindrical objects on end. This starts with a Single Hitch, then a number (six to ten) of turns; the running end is then taken back and inserted into the Single Hitch (211).

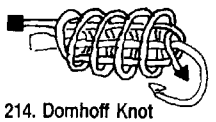
The **Albright Knot (212)** joins fishing wire or heavy-gauge monofilament to a lighter gauge monofilament. Double back the wire or heavy line, pass the

212. Albright Knot

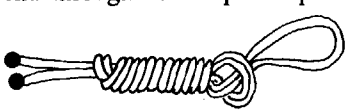
light line through and along this bight and wind back over all, keeping the turns tight. Finish by passing the running end through the end of the bight in the opposite direction to the standing part, and work all tight. The knot can be used in rope provided the smaller rope nearly fills the eye of the larger.

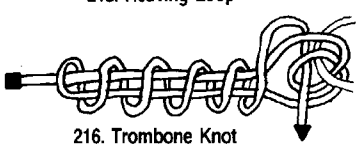


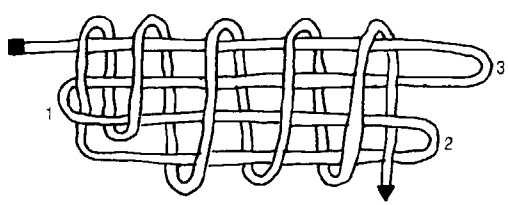
213. Heaving Line Knot


214. Domhoff Knot

When throwing a rope of any length it is necessary it is necessary to have some extra weight on the end. One knot for this purpose, also used by Franciscan monks as a weight on the end of the cord they use round their waists, is the **Heaving Line Knot (213)**; make a loop and wrap the running end round the loop a number of turns (213A), keeping the turns tight and close. Pass the end through the loop and pull tight (213B). Essentially the same knot, as a **Domhoff Knot (214)** tied round the shank, can be used to join a fishing line to a spade-end hook, or, after passing through the eye, to an eyed hook. Again, a **Heaving Loop (215)** tied in doubled line with a long loop protruding, can be used in fishing line as a leader loop or for sea traces, or, tied in rope, as a rescue line. Finally, a **Trombone Knot (216)** has a round turn in the eye of a hook through which the running end is passed.

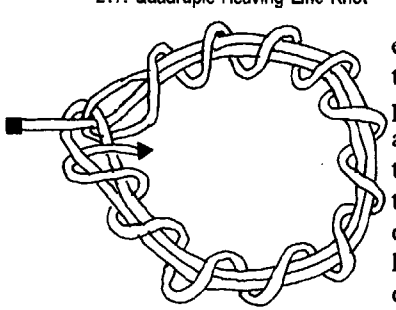

215. Heaving Loop


216. Trombone Knot



217. Quadruple Heaving Line Knot

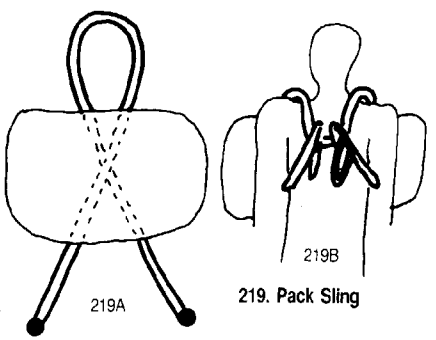
Often, the Heaving Line Knot (213) is a little light; a heavier version is the **Quadruple Heaving Line Knot (217)**; Four lengths of rope are doubled up as shown; the running end is then passed through loop 1 and one turn taken round loop 1 and the standing part before the required number of turns are taken round all ropes and then passed through loops 2 and 3, keeping all turns tight and close. Pull tight by first pulling on loop 1 to tighten loop 2, then pull on loop 3 to tighten loop 1, and finally pull on the standing part to tighten loop 3. For rescue work it might be better to provide


218. Round Heaving Line Knot

the extra weight in the end by making a **Round Heaving Line Knot (218)**, which also provides something easily gripped by the hopeful rescued. Make a loop of the appropriate size and follow back with the running end (218A); if extra weight is desired, continue round several times. Pass the end through the bight at the standing part and wrap it round the ropes as shown, except that the coils should be fairly tight and close together. When you get back to the standing part, pass the end through the initial bight and pull on the standing part to lock the running end (218B); you will probably have to work the coils to achieve this. While this is probably the best heaving line knot for rescue purposes it takes a long time to make and so is better prepared ahead of need.

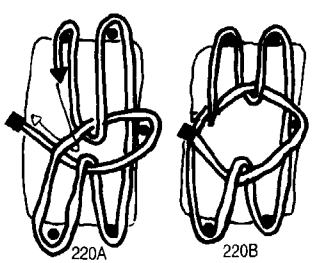
LONG CONTACT WITH AN ENCLOSED OBJECT

The **Pack Sling (219)** is used to carry a largish load over the back using a limited amount of rope. Pass a bight of rope behind the bundle, crossing the ends (219A). Either prop the load on a rock or stump or get someone to help you; pass the bight over the head in front of you and bring the ends up under the arms to fasten on to the bight with a quick release knot (219B). You may need to use a hand to keep the bight slipping back to choke you.



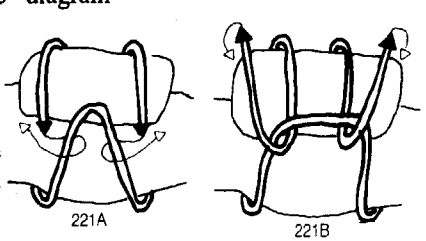
219. Pack Sling

The **Diamond Hitch (220)** is used to lash loads to pack frames, table-top trucks and some kinds of pack saddle using a single rope. The advantage of using a single rope is that a load on one point will tighten the whole rope; the disadvantage is that if anything slips out the whole load may be lost. Six points of attachment are needed; when the load is carried on an animal the central two would be on a girth. Start at one of the side anchorages and follow the diagram (220A), finally pulling all tight and make fast to the starting point (220B).



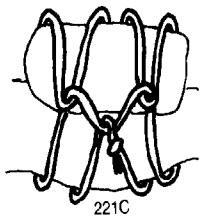
220. Diamond Hitch

The **Squaw Hitch (221)** is a somewhat similar knot used to lash a load direct to a pack animal (the rope must be suitable for the purpose) or to some kinds of frame. Place the load symmetrically on the animal and throw a bight over it and up under the belly

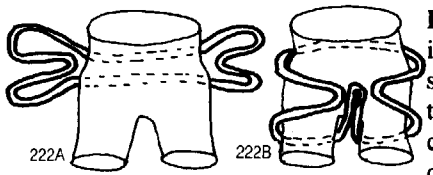


221. Squaw Hitch

(221A); pass the two ends through the bight and over the load again (221B). Bring them back under the belly and fasten round the bight (221C).

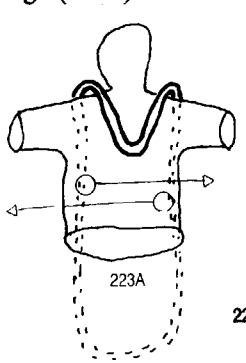


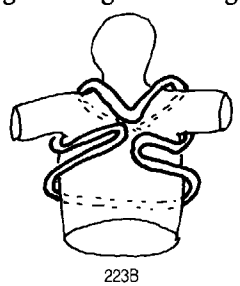
221. Squaw Hitch



222. Diaper Harness

The Diaper Harness Knot (222) is a way of using a sling, preferably of tape, as an emergency waist harness in climbing, rope rescue etc. Pass the sling behind you (222A) and bring a bight in front of you on each side and a third bight between the legs (222B). All three bights are gathered together and clipped into a karabiner; the length of the sling should allow little slack. The **Chest Harness Knot (223)** is a similar emergency chest harness. Place the sling behind you with a small bight over the shoulders in front (223A). Bring a bight from each side across to the opposite side to the front (223B). Again, you have one bight round your head and one under each arm, with one straight and two crossed ropes behind you. Gather all three bights in a karabiner; again, the length of the sling should leave little slack.





223. Chest Harness

Chapter 12
STRAND KNOTS

I have treated all the knots in this chapter as if made in 3-strand right-hand laid rope; however, they can equally be made on 3-strand sennits or any 3 strands held together in some way. Extension to left-hand laid rope or to 4, 5, 6 . . . strands, and to 2 strands for many, is straightforward. In all cases, all the strands are treated equally, but you need care with the last to avoid confusion. When made in laid rope, the knots are easiest to tie and most satisfactory in use when the rope is made with staple fibres, whether natural or synthetic, and

most difficult and least satisfactory with monofilament fibres. If the individual strands are actually ropes themselves, then any flexible construction, specially when the surface is relatively smooth, is good.

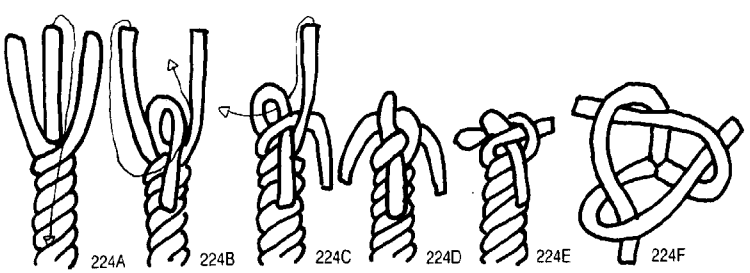
For learning and practice I use three (or whatever) lengths of a core and sheath cord of different colours, bound together at the base. To simulate laid rope I lay up a short length and tie a Constrictor Knot (150) in thin twine where the knot is to start. Indeed it is often a good idea to tie such a knot whenever the strands do not hold their lay and twist well.

Many of these knots when made with 4 or more strands will hold together better if tied round a core.

Many of these knots can be doubled by following a lead round. It is important that you follow the lead on the same side (above or below), or you will get untidy results. It does not matter for some purposes which side you follow, but the knots finish with the ends in different places, which may be important in some applications.

SINGLE STRAND KNOTS

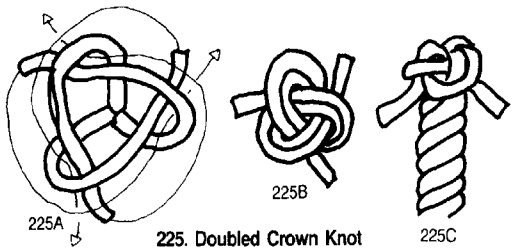
There are **Capping Knots**, where the strands finish pointing back along the standing part and mark the end of the rope, and **Lead Knots**, where the strands finish pointing away from the standing part; if desired the strands can then be re-laid so that the knot appears in the middle of the rope, or it can be used as a stopper knot by re-laying a short length and tying a short tight whipping just above the end and trimming off the end.



224. Crown Knot

The Crown Knot (224) is the simplest and by far the most common capping knot. It is rarely used by itself, though it can make a temporary stopper knot, but it is a component of many other strand knots as well as a Back Splice (256). To tie it, unlay a sufficient length and hold the rope with the centre strand away from you (224A). Bring that centre strand down in front of you and hold it against the standing part with a loop of about 2 or 3 strand diameters (224B). Take the left hand strand over the centre strand loop and pass it back between the right hand strand and the centre loop, pulling tight (224C). Pass the right hand strand over this and through the centre loop,

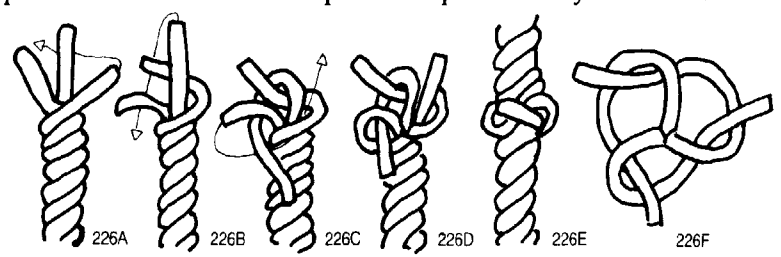
pulling tight (224D). Pull the centre strand tight and work the whole knot tight by pulling a little on each strand in turn (224E). The plan of the knot is shown in 224F which should make it easy to modify for left-hand laid rope or more than 3 strands.



225. Doubled Crown Knot

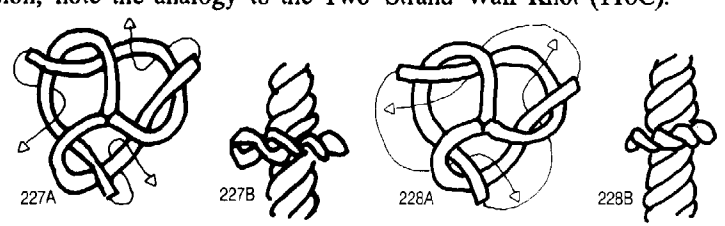
The **Doubled Crown Knot (225)** is a little more secure as a stopper knot and more decorative for some purposes. Make a Crown Knot (225A) and pass each strand over the next and down through the loop of its next (in 3-strand rope this is the loop formed by the strand you are using) (225B). Work tight (225C).

The **Wall Knot (226)** is the simplest of the lead knots. It provides a small stopper in the middle of laid rope and is part of many other strand knots.



226. Wall Knot

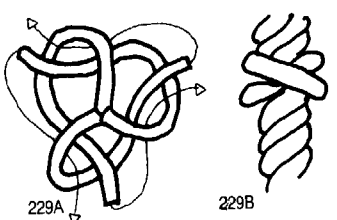
Again hold the rope with the centre strand away from you (226A). Pass the right-hand strand round behind the rope and hold it with a small loop showing (226B). Take the centre strand over the other two, pulling tight in front (226C). Pass the left-hand strand round and under the centre strand and up through the loop (226D). Work tight, a little at a time on each strand in turn, and if desired re-lay the rope (226E). The plan of the knot is in 226F to allow extension; note the analogy to the Two-Strand Wall Knot (116C).



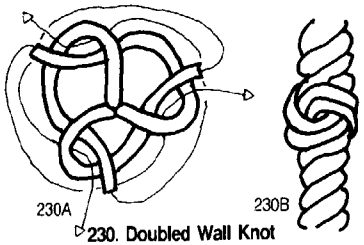
227. Duo Wall Knot 228. Double Wall Knot

The Wall Knot may be doubled in many ways; four of the commonest are shown here. The **Duo Wall Knot (227)** has an extra turn taken round each loop (227A); it is difficult to work tight neatly but gives a very wide disc round the rope (227B). The **Double Wall Knot (228)** gives a smaller disc

(228B); from the Wall Knot (226) pass each strand down and up into the middle of the next loop (228A). The **Matthew Walker Knot (229)** gives a

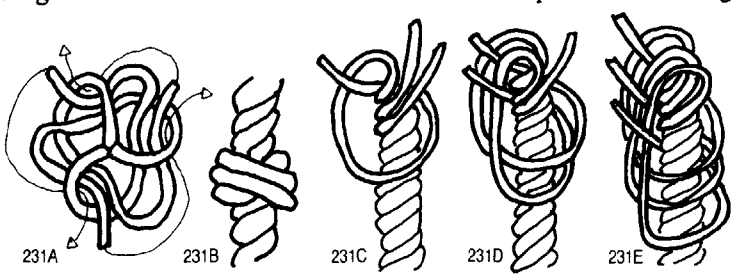


229. Matthew Walker Knot



230. Doubled Wall Knot

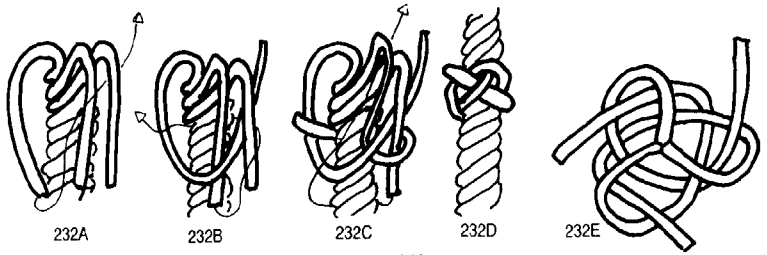
narrower but longer and more decorative knot (229B); pass each strand into the next loop (229A) as in 228 but into the running space; note the analogy to the Two-Strand Matthew Walker Knot (115F). The **Doubled Wall Knot (230)** is the analogue of the Doubled Crown Knot (225); pass each strand of the Wall Knot (226) under the next loop and up through the next (230A); the resulting knot has each strand in an Overhand Knot parallel to its neighbour.



231. Double Matthew Walker Knot

The Matthew Walker Knot (229) can itself be doubled or indeed tripled or more if you have the patience, producing longer and longer knots. The **Double Matthew Walker Knot (231)** can be made by starting with a Matthew Walker Knot (231A) by taking each strand down and up into the next running space and working tight (231B); this is repeated for triple or higher knots. This knot has three interlocked Overhand Knots, analogous to the Two-Strand Matthew Walker (115); for four strands you would need a Triple Matthew Walker to get linked Overhands. A somewhat simpler way of tying the Double Matthew Walker Knot, a bit more tricky to work tight and even, is to make the Overhands direct. Start with the centre strand towards you; pass the left-hand strand down, in front of the standing part and round behind it and into its loop to make an Overhand Knot (231C). Form the centre strand into an Overhand Knot in the same way, passing it in front of the first strand facing you and inside it to form the knot (231D). Repeat with the right-hand strand (231E). Take care to keep the strands in order when working tight.

The **Diamond Knot (232)** is one of several decorative knots that finish with each strand encircling the core with the circles more or less at right



232. Diamond Knot

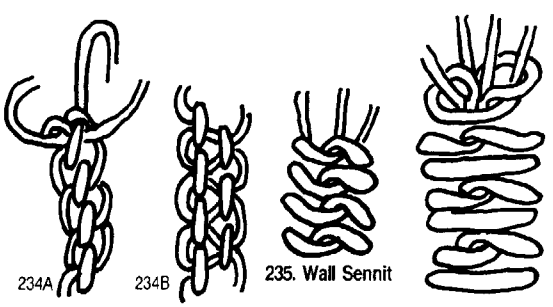
angles to each other; the differences lie in how the ends emerge. A single-strand analogue is the Monkeys Fist (497). The Diamond Knot forms a substantial knob in mid-rope and has been used to provide hand or foot holds in a rope. Hold the rope with each strand hanging down alongside the standing part (232A). Pass the first strand across the second and up into the loop of the third (232B) and repeat with each strand in turn (232C, 232D). Some find it easier to follow the plan in 232E, analogous to 232A without the tuck of the Wall Knot.

233. Double Diamond Knot

The Diamond Knot (232) can readily be doubled or tripled or more. The **Double Diamond Knot (233)** is most attractive in 3-strand rope. Make a Diamond Knot (232E); notice that each strand emerges from the knot beside and parallel with a strand from the standing part (in 3-strand rope this is the strand you are working with). With each strand in turn, follow this parallel strand through two tucks, back to the starting point.

REPEATED STRAND KNOTS

These knots have several of the one kind strand knot.



234. Crown Sennit

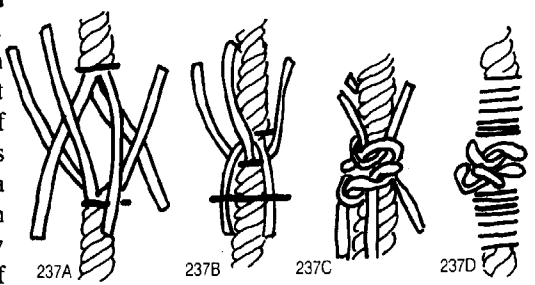
236. Alternate Wall and Core Sennit

The **Crown Sennit (234)** consists of repeated Crown Knots (224) one on top of the other. If all the Crown Knots are of the same handedness (234A) a spiral twist, of the same handedness as the knots, results. If of alternating handedness (234B), a more chain-like sennit is formed, of roughly triangular section for three strands. A core should be used for more than five or six strands. Larger sennits can also be made by using strands in pairs or threes.

The **Wall Sennit (235)** is more likely to benefit from a core, even for 3-strand sennits. Wall Knots of alternating handedness do not make a very attractive sennit. A way of doing without a core is shown as the **Alternate Wall and Core Sennit (236)**, which uses four strands which act in pairs, alternately forming a 2-strand core and a 2-strand Wall Sennit, then changing roles.

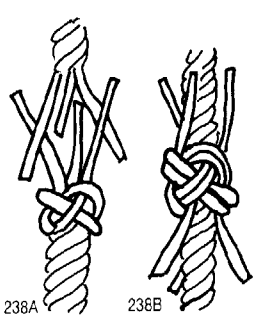
Other lead strand knots have also been used in sennits.

Shroud Knots (multi-strand bends) were used for emergency repairs of hemp rigging. Especially in standing rigging, the Common Shroud Knot (237) is quicker to tie than a splice, or than a bend if the ends need whipping, and the amount of rope used is minimal. The more elaborate shroud knots may not have these advantages, but they make decorative permanent bends.



237. Common Shroud Knot

The **Common Shroud Knot (237)** is the simplest. Unlay a short section of each rope and **marry** the two, that is, mesh the two sets of strands together (237A). It is often an advantage to put a Constrictor Knot (150) on each rope immediately below the splay. Lay the first set of strands against the second standing part (237B), possibly keeping them in place with another Constrictor Knot, and make a Wall Knot (226) with the second set of strands around a core of the first standing part. Then repeat the process with a Wall Knot in the first strands (237C). The traditional way of finishing the knot is to tease out the ends of the strands and thin out towards the ends to taper them. Serve to the standing parts (237D). Another way of finishing is to put in one or two tucks of ordinary splicing (254). Any of the Double Wall Knots (227–230) or the Double Matthew Walker Knot (231) could make more secure Shroud Knots.



238. Diamond Shroud Knot

The **Diamond Shroud Knot (238)** is both more secure and more decorative. Make a not too tight Diamond Knot (232) in one rope, leaving long ends. Unlay the other the other rope and marry the two (238A). Follow each strand of the Diamond Knot with the adjacent strand of the second rope, including the tuck down the centre of the rope to the start of the knot (238B). Work both ropes tight and finish as before. It would probably be satisfactory to just trim off the ends close to the knot; if using synthetic rope it might be best to heat seal the ends into a bit of a button to prevent slipping. It

is also possible to make a **Double Diamond Shroud Knot** by making Diamond Knots in both ropes, marrying and following the lead as before in both ropes.

MIXED STRAND KNOTS

These contain a capping knot and a lead knot. They are used to form more or less spherical knob knots or flat disc button knots on the end of a rope, or lead knots in the middle.

239. Manrope Knot

The **Manrope Knot (239)** is the commonest knob knot. Make a Wall Knot (226) and follow with a Crown Knot (224) on top. Note that each strand comes out of the Crown Knot beside a strand entering the Wall Knot (in 3–strand rope, these are the same strand). Follow each round two tucks, so that the knot is doubled (239); if you repeat this process the knot may be a bit hollow in the middle, which you could use to take a spherical core. In rough natural–fibre rope the ends of a tightly worked knot may hold if trimmed off short, otherwise trim a bit longer and tuck into the centre of the knot, possibly sewing in place with a few stitches. I have seen an effective finish to a Manrope Knot tied in a white synthetic rope: the ends were heat–sealed into a broad flat button using a smoky flame, so that they appeared as round black eyes in the middle of the knot.

240. Diamond Rose Knot

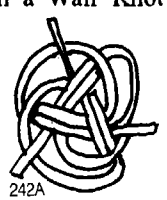
Another knob knot is the **Diamond Rose Knot (240)**: make a Diamond Knot (232), follow it with a Crown Knot (224) on top and then double the Diamond Knot as in the Diamond Shroud Knot (238). The similar knot made by crowning a Double Diamond Knot (233) is not as secure.

A Crown Knot (224) and then a Wall Knot (226) below it makes the

241A

241B

241. Stopper Knot


242A

242B

242. Cat Stopper Knot

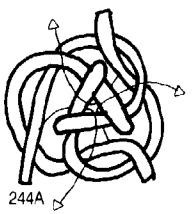
243. Rose Knot

Stopper Knot (241) which can be used as a simple knob knot (241B), very similar to a single–tuck Manrope Knot (239). It can also be flattened out into a disc or button with the Crown Knot in the centre (241A). An even more effective disc is to make the Stopper Knot and then double the Crown Knot, to give the **Cat Stopper Knot (242A)**. This does not make a very elegant knob knot (242B) but if you go on to double the Wall Knot you get a knot very similar to the Manrope Knot.

The original **Rose Knot (243)** consists of a Crown Knot (224) with a Doubled Wall Knot (230) tied below it; this is an attractive knob knot but could be formed as a button.

The above should give suggestions for making a wide variety of knob and button knots, with variations depending on the order of tying the capping and lead knots and whether a knot is doubled with the end above or below the lead.

The **Footrope Knot (244)** is actually a Diamond Knot (232) tied upside down (compare the two–strand versions, 127B,C). Tie it by making a Stopper Knot (241), that is, a Crown and Wall Knot (244A), then tuck each end into the centre of the Crown knot as shown, and re–lay the rope (244B). The knot gets its name from its use on the footropes below the yards of square–rigged sails.

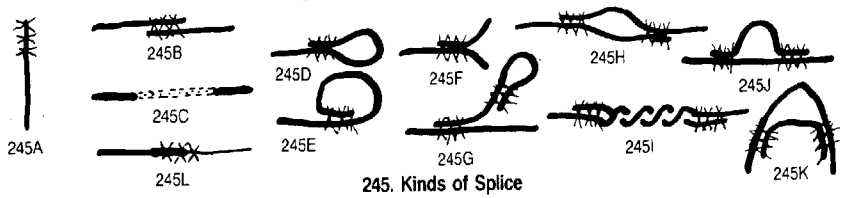

244A

244B

244. Footrope Knot

Chapter 13
SPLICES

Traditionally, splicing involved the interweaving of the strands of two ropes or parts of a rope, but the term has been extended to cover similar functions in modern constructions of rope.



245. Kinds of Splice

There are many kinds of splice, but most of them contain one basic means of interweaving for the kind of the rope, with different starts. A **Back Splice (245A)** turns the end of a rope back on itself; this prevents the end fraying or unlaying and increases the diameter so that it acts as a stopper. There are, in general, two kinds of **End to End** splices, permanent bends, the **Short Splice (245B)** which has an increased diameter at the join and a **Long Splice (245C)** which does not but provides sufficient grip by extra length.

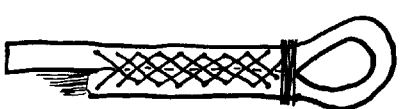
An **Eye Splice (245D)** forms a permanent loop. The same construction can be used in many kinds of rope to make a variety of formations. A more truly

circular loop is formed by a **Side Splice (245E)**, a second rope can be inserted with a **Branch Splice (245F)**, or a loop added with a **Bight Eye (245G)**. Two ropes can be joined around an eye in a **Cut Splice (245H)**; if, after making the first splice of a Cut Splice, the end is twisted around the other standing part against the lay of the rope and the second splice is made, we have a **Log Line Splice (245I)** from its original use with laid log lines, but now mainly providing a substantial handhold in the middle of a rope. A **Cringle (245J)** provides a loop external to a line, and a **Horseshoe (245K)** provides a strut across a corner. Protection of an eye against wear can in most applications be provided by a metal or plastic thimble; longer loops can be protected by using a length of hose, preferably nylon, placed over the rope before splicing. When a thimble is not used, protection can be provided by serving the rope, but a single break in the serving spills the lot, so it is better to use a coxcomb such as the Single-Strand Zigzag Coxcomb (386) or a variety of West Country Whipping (13) with knots only on the outside of the eye.

Finally, a **Tail Splice (245L)** joins wire to fibre rope; some wire halyards have rope tails for easy handling when not fully laden.

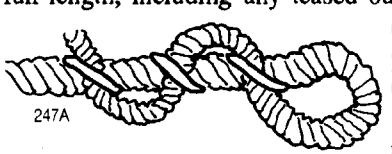
SPLICES WITH NO DIFFERENTIATION OF THE ROPE PARTS

In these splices either the whole rope is used for tucking, or portions of the rope that have no essential relation to the strands.



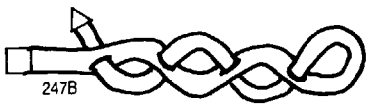
246. Sewn Splice

A **Sewn Splice (246)** makes an Eye Splice or any of its derivatives (245D–K) in any kind of rope through which a needle can be passed; its main application is for the kinds of rope which it is difficult or impossible to splice by other, stronger, ways. The overlap of rope after the eye should be around ten times the diameter of the rope, or more if you want to taper the end. Tie a small but firm seizing at the throat of the eye, which should include the thimble if used. Use a strong whipping twine, preferably waxed, and a sailmakers needle if possible, and pass the needle straight through one rope, a bit away from the centre. Stitch a number of times to hold the two ropes together; it is best to lead the stitching up and down the rope a few times, so that any pull together is reinforced. Then put a serving along the full length, including any teased out, tapered end that may be wanted. If you do not have a serving mallet it would probably be best to make a long West Country Whipping (13).



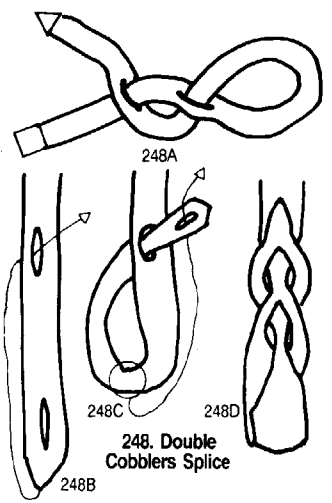
247. Single Cobblers Splice

The **Single Cobblers Splice (247)** also makes an eye splice or derivatives (245D–K) in any rope sufficiently softly constructed to open up a hole in the middle large enough to pass the running end through. For laid rope, open up a strand of the standing part and pass the running end through, and repeat the process so that each strand is tucked up (247A). For other constructions of rope, open up the standing part as evenly as possible (247B). Stiff slippery rope needs more passes than flexible rough rope. But note that an uneven pull on the legs of the loop favouring the running end side may pull it right out.



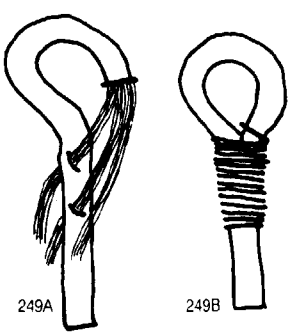
247. Single Cobblers Splice

The **Double Cobblers Splice (248)** makes a secure Eye Splice (245D only) in the same sorts of rope as 247. Pass the running end through the opened up standing part and then pass the standing part through the opened up running end. The splice can be used as a **Corner Splice** where there is load on both ends as well as the eye; if the load is likely to be markedly uneven, an extra tuck with each rope is desirable. A similar construction can be used with leather thongs. There should be two slits, the distance apart equal to the circumference of the loop (248B). Pass the running end through the standing slit (248C) then either pass the standing part through the running slit or work the loop through the running slit, inverting and working the kinks out (248D).



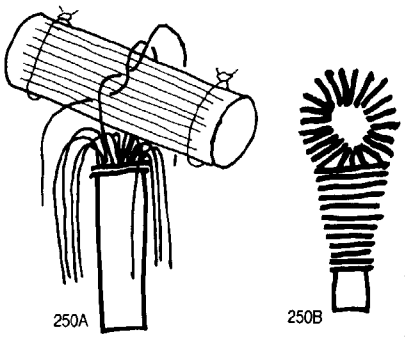
248. Double Cobblers Splice

The **Stuck Splice (249)** makes an Eye Splice or its derivatives (245D–K) in plaited or braided rope that is too stiff to open out far enough to pass the whole rope through, or where a neater splice than 247 or 248 is wanted, but no satisfactory other splice is available. Put a small tight whipping about eight rope diameters back from the end, and unravel the end. Spike a hole through the standing part at the base of the eye and use a needle or awl to pass as much of the unravelled end through as possible; if you can't get very much through, repeat the process with other samples (249A). Draw tight to the start of the unravelling. If possible there should be several more tucks, or the seizing will be carrying most of the load. Taper out the ends and put on a firm seizing (249B).



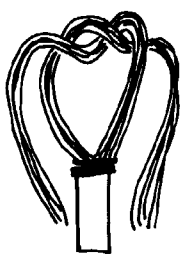
249. Stuck Splice

The **Flemish Eye (250)** is an Eye Splice (245D only) that can be made in any type of fibre rope, laid, plaited or braided. It can form a smaller eye than can be formed by any other way, and that justifies the amount of trouble needed to make it. Prepare a spindle of a diameter the same as the desired eye

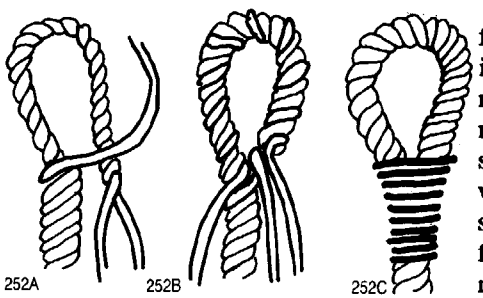


250. Flemish Eye

by fastening a number of pieces of twine long enough to tie a knot round the rope with plenty of spare (250A). Put a small tight whipping on the standing part at a distance from the end to go completely round the spindle plus about another eight rope diameters. Unlay or unravel the rope to form an even number, perhaps 14–24, of yarns; these may need waxing to hold together. Hold the spindle close to the whipping and take pairs of these yarns round the spindle, making a Half Knot, allowing the ends to hang back along the rope, tapering as desired (250A). When all the yarns are over the spindle, fasten the twine round them, remove the spindle, and then serve the eye and the standing part (250B).

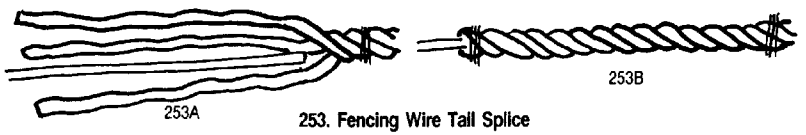

251. Hard Plait Eye

The **Hard Plait Eye (251)** is a similar but simpler splice for larger eyes in rope too hardly plaited or braided for a Stuck Splice (249). Put on a small tight whipping as for 250 and unravel the rope, separating into two parts (251A). Knot these with an Overhand Knot at the right place to form the eye and serve both eye and standing part as in 250B.



252. Grommet Splice

A Grommet Splice (251) forms an Eye Splice (245D only) in any rope you can unlay and re-lay. Thus it is suitable for laid rope and multiplait; it is quite suitable for nearly all kinds of wire rope, and is the only wire splice that I shall mention. Carefully unlay the rope into two more or less equal portions. Hawser-laid rope gives one portion of two strands, which should be kept twisted, and one of one; wire rope should have the heart-strand kept with one portion and the twist in the two portions retained. Multiplait rope should keep the pairs of strands together and twisted, with a right-handed and a left-handed pair on each side. It is usually most convenient to take one portion right round the course of the eye (252A) and then use the other portion to reform the rope round the eye from the other direction. Remaking plaited rope in this way is not quite the same as ordinary plaiting and some practice may be needed. Thus you finish with a loop and ends coming out at both sides of the junction (252B); put on a firm serving round the ends, tapering if desired.



253. Fencing Wire Tail Splice

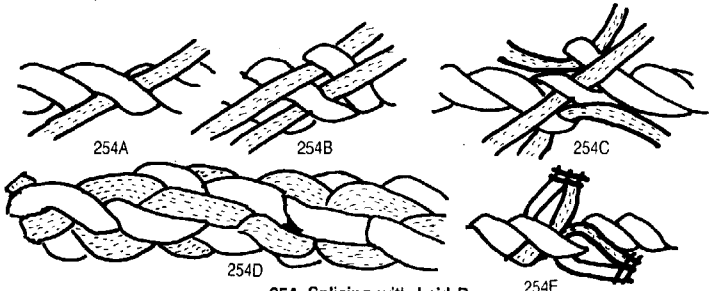
A Fencing Wire Tail Splice (253) can be used to get a good grip on solid (not stranded) fencing wire for emergency repairs or tightening. It is really only likely to work if the wire is not too shiny and if the rope is of natural fibres, and of diameter several times that of the wire. Unlay the rope for about 20–30 rope diameters (253A). It will probably help if you tie a light whipping or a Constrictor Knot (150) here. Insert the wire into the heart of the rope and re-lay the strands tightly around it (253B). You may need a Constrictor Knot at the end of the strands also. The rope can then be used to strain the wire, a lot more comfortably then trying to pull on the wire by hand.

SPLICES WITH INTERWEAVING STRANDS

It is often possible to splice stranded rope, whether laid or plaited, by interweaving the strands.

Laid Rope

It seems likely that splicing saw its major development in the age of sail when there was considerable need for permanent loops and joins in hawser- and shroud-laid rope. The main body of these splices in most cases consisted of the strands of one rope passing over and under the strands of another rope or part in a regular fashion; the differences between splices lies in the start.

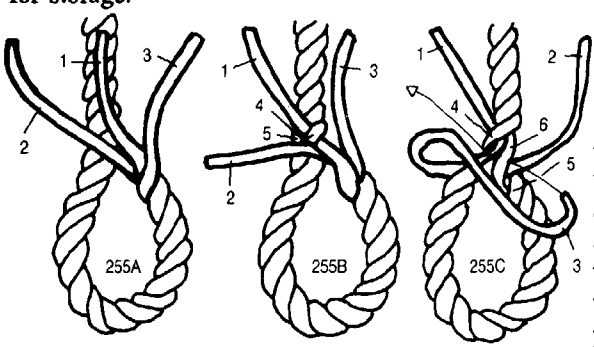


254. Splicing with Laid Rope

Thus the first strand is tucked under a strand of the second against the lay (254A). With hard-laid rope you may need the help of a marlinespike to open up a space or a swedish or grooved fid to open up space and feed the strand through. The second strand then passes over the strand you have just passed under and under the next (254B). The third strand does exactly the same thing on the other side of the rope, but you need to take care not to get confused with previous tucks (254C). After completing a tuck for each strand, work

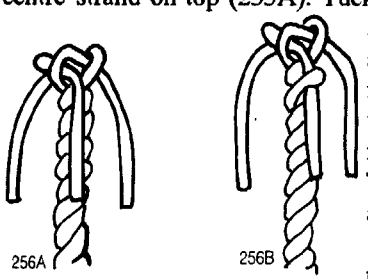
tight by gentle pulls on each strand in turn, several times round. Check for errors by noting that no two strands should come out of the same gap between strands, and that the end-on view shows three strands at roughly equal angles of 120°. The body of the completed splice should look something like 254D, with the tucked strands shown dotted and moving straight or twisted a little; you need at least two tucks after the starting tuck in natural ropes, at least four in synthetics. Even up the splice by rolling it between the hands. You may like to taper the end of the splice. After completing the tucks as recommended, either remove part of each strand and tuck again, maybe repeating the process, or remove one complete strand, tuck the others, and remove a second strand and tuck the last. For greater security, specially with slippery synthetic rope, do not taper but leave the strands long; halve each strand and unite each half with half the adjacent strand with a whipping and, for synthetics, a heat-seal (254E); this is known as **Dogknotting** or **Cross-Whipping**. For a decorative finish, make the starting tuck of the splice and then either make a knob knot such as the Manrope Knot (239) around the standing part, or make a lead knot such as a Double Diamond Knot (233) around the standing part, followed by a couple of tucks of ordinary splicing, maybe with a taper.

Rope for practice splicing should have each strand whipped or heat-sealed if synthetic, and a very short Palm and Needle Whipping (14) where you want to unlay the rope. Re-lay the rope and place some sort of temporary whipping for storage.



255. Eye Splice (Laid Rope)

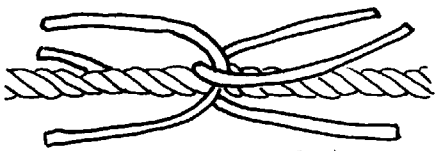
The **Eye Splice (255)** can be used in all applications 245D–K. Unlay the necessary amount of rope; a short whipping may be desirable if the rope is soft and does not hold its lay well. Hold the end over the standing part where you want the throat of the splice, with the centre strand on top (255A). Tuck this centre strand 1 under a strand 4 of the standing part (255B); take the left-hand strand 2 over that strand 4 and under the next 5. Turn the splice over (255C) and tuck the original right-hand strand 3 under the remaining strand 6 in the direction indicated. This is the starting tuck complete; work tight and complete the splice as described above.



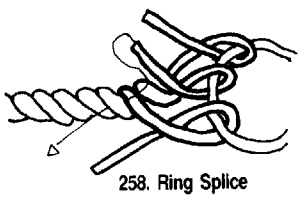
256. Back Splice (Laid Rope)

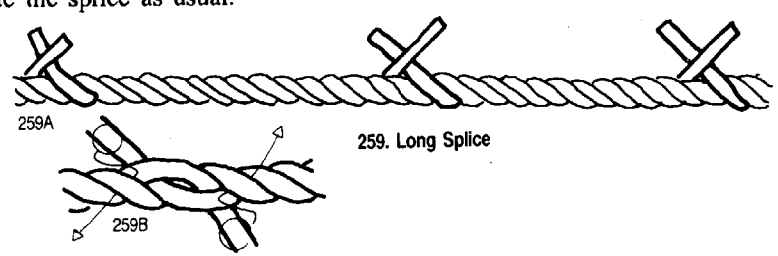
The **Back Splice (256)** is usually best regarded as a temporary whipping, though it also serves as a stopper knot. Unlay the required amount of rope and make a Crown Knot (224: 256A). Take each strand in turn and splice down the rope as before (256B).

The **Short Splice (257)** is a permanent join between two ropes; properly made in natural fibre rope, it is as strong as the rope in which it is made. Unlay the needed amount of both ropes; especially in synthetic ropes it might be best to make a short whipping at the end of the unlaid section. Marry the ropes (257), with any whippings close together and make one tuck with each of the six strands; this is the start, so complete with both ends as before.


257. Short Splice (Laid Rope)

The **Ring Splice (258)** fastens a rope close up to a ring; since a thimble cannot be used, there should be as little slack as possible. It may also be used to fasten a rope to a chain. If the ring or chain is very narrow, it may be necessary to ride one of the turns into it. Unlay the rope and hold it over the ring with the centre strand on top (258). Pass the centre strand over and into the ring and back up between the centre and right-hand strand; pass the left-hand strand over and into the ring and back up between the left and centre strands; pass the right-hand strand under and into the ring and back down between the right and central strands (258). The centre strand then passes over the right-hand strand and under the next as indicated and so on to complete the starting tuck. Work tight well and complete the splice as usual.


258. Ring Splice



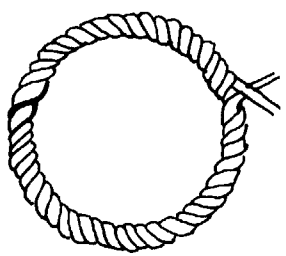
259. Long Splice

The **Long Splice (259)** joins two ropes with minimal increase of thickness. Since a large part of the grip holding the two ropes together is just the friction of two strands together in the lay of the rope, the splice has to be very long if it is to hold any load; the overall length of the splice should be at least 100 times the diameter of the rope, more for synthetics. Unlay each rope for 50 rope diameters or more and marry the strands as in 257. Unlay one strand of one rope, replacing it with the strand of the other that was ahead of it in the marry. Great care must be taken in this re-laying; if the strands hold their twist and it is easy to tell the inside and the outside of the rope, this is fairly straightforward, but if they do not, it is quite tricky to get all the twisting even.

Unlay one strand of the second rope, replacing it with the corresponding strand of the other. The rope should now be as in 259A. Join each pair of strands with a left-hand Half Knot (259B) and then make at least one tuck with each end as shown. If the slight extra thickness of these tucks is unacceptable, halve them, but if at all possible the Half Knots should use the full strands.

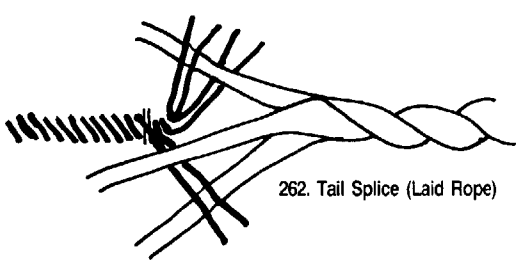
260. Pudding Splice

The **Pudding Splice (260)** is used when one strand of a long rope is damaged in one place. The damaged portion is removed together with about 30 rope diameters on each side, more for synthetics. This is replaced with a strand of another rope of the same material, size and construction and as close to the same wear and weathering as possible. Join the two ends as for a Long Splice (259B).



261. Grommet

A **Grommet (261)** is a continuous ring of rope, used for slings and the like; a quoit should have a wire core. Unlay a strand from a rope about 12 times the diameter of the finished grommet in length. Taking care to keep the twist in the strand, form a ring of the required diameter in the middle of the strand. It is often easier to start by making an Overhand Knot of the same handedness as the rope. Re-lay each end to form a three-strand ring, and join the ends as for a Long Splice (259B).



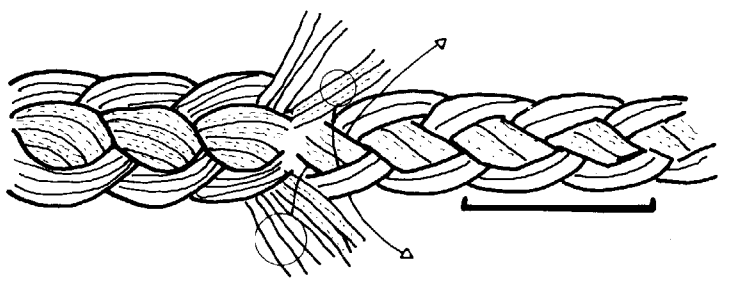
262. Tail Splice (Laid Rope)

The **Tail Splice (262)** joins a wire and a fibre laid rope. Both ropes need preparation. The fibre rope should be unlaid about 10 rope diameters and the strands tapered by scraping mainly on the inside; they may need waxing to maintain their integrity. The wire should be unlaid for a similar distance; put a firm short whipping before unlaying. The heart strand should be cut out and the other strands kept in adjacent pairs. Their ends need to be treated to prevent unlaying; this can be done in some ropes by giving the tips a tight twist in the direction of the lay; others can take a drop of solder; for the rest a whipping with thin twine round both strands together or a wrap with splicing or electrician's tape could be used. Then marry the ropes, keeping the wire strands in pairs (262). Tuck the paired wire strands into the fibre rope as for a Short Splice (257), then the tapered fibre strands into the wire, regarding the paired wire strands as one

throughout the splice. If the fibre rope is substantially thicker than the wire, it is best to re-lay the fibre rope after tapering and unlay the wire for double the distance; then do all the tucking with the paired wire strands. The ends of the wire strands can be stitched to the inside a nearby fibre strand in the heart of the rope to prevent snagging your hands on the wire ends.

Multiplait Rope

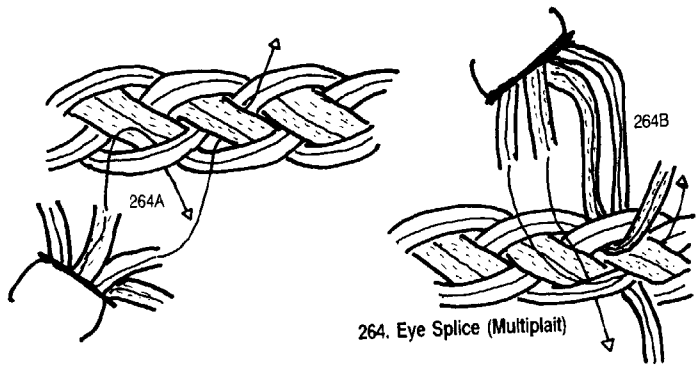
Many plaited ropes without significant cores can be spliced by interweaving the strands, but you are most likely to want to splice multiplait or square rope, used for tow ropes, anchor ropes, mooring ropes and the like, and those splices are the only ones that I discuss.



263. Splicing with Multiplait Rope

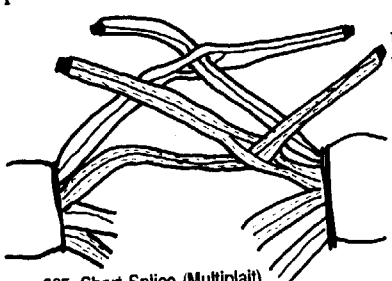
Splicing multiplait rope is a relatively new art and there are several recognised ways of doing it, with little or no information on which is the best. Perhaps the simplest is to keep all strands in their pairs and to tuck all paired strands beside paired strands of the same handedness in the standing part. It is convenient to have some marking to recognise the handedness at a glance. Some ropes are manufactured with markers on all strands of one handedness, otherwise make your own marks with a felt-wick pen; I have found the fluorescent highlighting pens useful because the marks wash out readily. Mark before unlaying; whip and/or heat-fuse the ends of the pairs of strands and then unlay, keeping all twists intact; a small whipping at the end of the unlaying is useful. A marlinespike or swedish fid is essential. As with laid rope, different splices start differently, but the body of the splice is the same. Take, say, a right-handed pair and tuck it under a left-handed pair in the same direction as the right-handed pair of the standing part (263). At the end of the splice it adds security to separate the pairs of strands and dogknot with adjacent strands across the rope. The measuring bar indicates the length of one repetition, sometimes called one **stitch**.

The **Eye Splice (264)** can be used in all applications 245D–K. Place a small tight whipping at about 5 stitches from the running end, mark, whip and unlay the pairs of strands to that point and place in position to form the eye. Hold it so that a pair of strands of each handedness is on top. Tuck the marked pair under an unmarked pair and alongside a marked pair in the standing part,



264. Eye Splice (Multiplait)

working towards the standing end. Then tuck the unmarked pair beside the unmarked pair you have just tucked under, and under the next marked pair (264A). Turn the splice over and select tucks for the remaining pairs as close to the first as possible, taking care that you are following the previously unused pairs in the appropriate direction (264B). Work tight and continue the splice as before, working each tuck tight.


265. Short Splice (Multiplait)

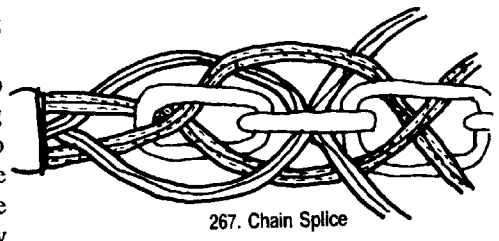
The **Short Splice (265)** is made by unlaying about 5 stitches of each rope as before. Marry the two ropes; things hold together a little better, and there is a little extra security if you interlace the pairs of strands between the legs of the corresponding pair of the other rope (265). Bring the two ropes together. It is often convenient to put a light seizing over all to one side of the join and then splice the pairs on the other side, then remove the seizing and complete the splice.

266. Back Splice (Multiplait)

A Back Splice (266) needs only 3–4 stitches. Unlay as before but separate each strand in the pairs. Use the right-handed pair to make a 4-strand right handed Crown Knot (224); leave the ends beside the standing part and then use the 4 left-handed strands to make a left-handed Crown Knot around the right-handed strands (266) and work tight. Reunite the pairs of strands and complete the splice.

The **Chain Splice (267)** unites a multiplait nylon rope to a chain such as that attached to an anchor. The size of the rope should be such that two pairs of strands make a fairly tight fit passing through the chain links. Whip the rope at a length equal to 12 chain links from the end, and whip and unlay the pairs of strands as before. Pass the two right-handed pairs into the first chain link

in opposite directions (267); then pass the two left-handed pairs into the second link and so on (267). Finish by separating the pairs of strands and rewhip (and heat-seal) around the side of the adjacent chain link. If the anchor is to be used on a rocky bottom, the splice can be protected by a serving.


267. Chain Splice

SPLICES INVOLVING INSERTION OF ROPES

All the splices in this section involve inserting one plaited rope or part thereof along a length of another. Obviously, the ropes must be sufficiently loose and flexible to allow this. A rough indication of this possibility is to hold a few centimetres of a bight between the fingers of the two hands and compress the rope lengthways; if it cannot be compressed to about half its length or less it is unlikely to be suitable for this kind of splice.

Many different rope constructions are in use; specific splices have been developed for quite a number of these, sometimes several different splices for the one construction. I have not seen any detailed comparative tests, so I make no attempt to describe them all, but try to give something for any construction. These splices may be difficult to learn out of books, much easier from an experienced teacher.

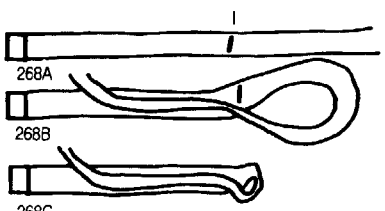
It is advisable for security to support all these splices with tight whippings, preferably the Palm and Needle Whipping (14), or with a number of stitches, at appropriate places, such as the throat of eye splices.

Mechanical aids are needed to make insertions along cylindrical ropes. For looser constructions or smaller inserts it is usually sufficient to taper the end of the insert and use adhesive tape (electricians' insulating tape is satisfactory if you do not have riggers' tape) to fasten it smoothly to the end of a pointed stiff wire of appropriate length to push the rope through; sometimes a splicing needle or a stiff wire with a small loop on the end can be used to pull rope through. A Swedish grooved fid may well be useful. For tighter constructions a hollow fid of appropriate size and a pusher are needed. Special fids of this type are made for double braid rope, useful also for other plaits and braids. These have a diameter about 1.5 mm less than the diameter of the rope they are made for, a total length of about 22 rope diameters (called a **fid length**) with a mark about 8 rope diameters from one end (called a **short fid length**); one end is pointed, the other is hollowed out for a couple of rope diameters to accept in a tight fit either the core or the sheath after folding and taping. The pusher should fit in this hollow and hold the insert in place. The terms fid length and short fid length are used in this section for convenience throughout, even when the special fids are not really needed.

Most of these splices involve marking the sheath or core in various places; felt tip pens are suitable, the fluorescent highlighters being easy to wash out. Sometimes six or more marks need to be distinguished; different colours or letters (on the sheath) or roman numerals (on the core) may be used. These splices are often quite long; my drawings compress these lengths and are not to scale. The drawings in general show a cross-section. This allows you to see and understand what is going on inside the sheath and, I hope, make external appearances less confusing. You will need to take care in interpreting the drawings.

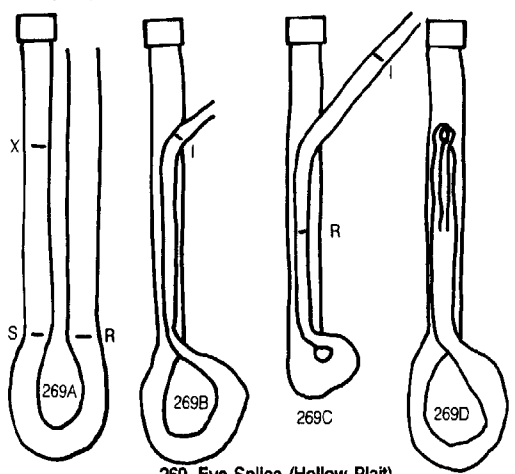
Hollow Plait

Hollow plait rope is the easiest to splice. It can readily be opened up by grasping in both hands, about 150–200 mm apart; bring the hands together. This opens up the splice for insertions.



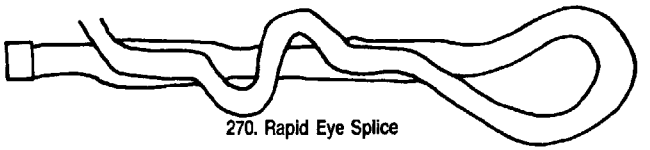
268. Back Splice (Hollow Plait)

A Back Splice (268) is started by making a mark I about a short fid length from the running end (268A); it may be desirable to tape the end. Insert the end into the standing part at the mark and out at about half that distance (268B). Pull the end out until the eye disappears (268C); trim the end off flush and tuck it into the rope. If the end is to be subject to much whipping action a couple of stitches might be advisable.

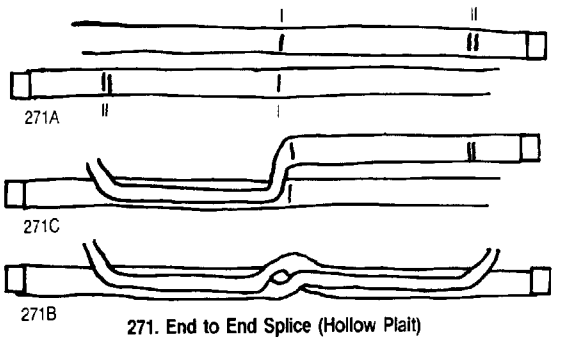


269. Eye Splice (Hollow Plait)

The **Eye Splice (269)** is suitable for all applications 245D–K. Make a mark R about 1½ fid lengths from the end, form the required eye and mark the standing part S opposite R at the throat; put another mark X on the standing part about a fid length from S (269A). Insert the end at S, exiting at X; mark the end I where it exits (269B). Pull the end out a bit, reducing the eye a bit (269C) and make a Back Splice (268) at I. Open out the eye, tucking back the end into the standing part (269D); you will need to hold the slit open at S with one hand while pulling on the R end with the other. A **Rapid Eye Splice (270)** is particularly suitable for loosely plaited rope and crude tools. Allow a tail of about 1½ fid lengths, make the eye and insert the end for about ½ fid length,


270. Rapid Eye Splice

then straight through the standing part, then insert it for another ½ fid length, leaving a short end outside.

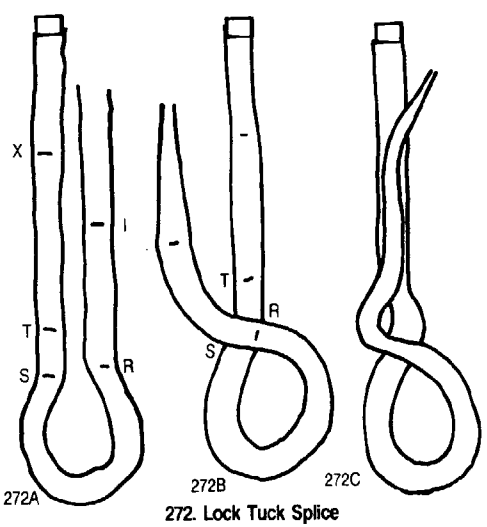


271. End to End Splice (Hollow Plait)

The End to End Splice (271) joins two hollow ropes with only a little increase in diameter. Mark both ropes I at about 1½ fid lengths and II at 1 fid length further back (271A). Insert one rope at I in the other, bringing it out at II (271B); repeat with the other rope (271C). Work the running ends to get the join as close as possible, trim them off and tuck back into the ropes.

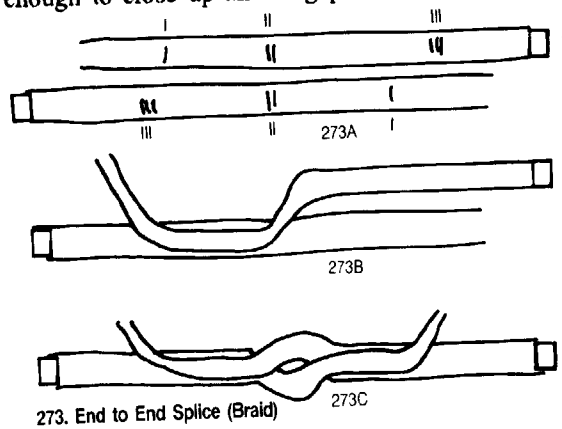
Core and Sheath Rope

The next two splices can be used with any core and sheath rope of sufficiently loose and flexible construction. The **Lock Tuck Splice (272)** makes any type of Eye Splice (245D–K). Mark I one fid length from the end and R at 2 fid lengths. Form the eye and mark S opposite R at the throat; then mark T at about 3 rope diameters and X at 1½ fid lengths from S (272A). Taper the end from I until after taping it will fit in the hollow fid; you may need to remove part of the core as well as part of the sheath, and the tape should cover all loose ends to prevent them catching. Pass the end right through the standing part at S and pull through to the mark R (272B). Then insert the end at T, exiting at X (272C). Work in the thimble if used and pull on the end to tighten the locking tuck. Cut off excess end and tuck it inside the sheath. Then milk the sheath



272. Lock Tuck Splice

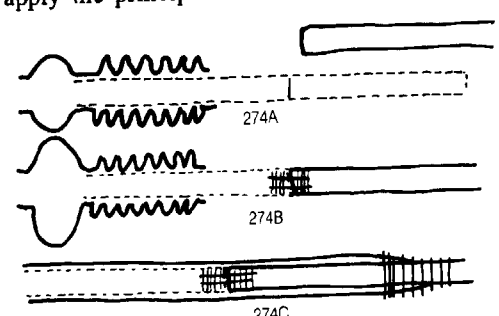
(work with the fingers away from the eye) until it is even. If the rope is soft enough to close up all the gap at the lock tuck, whip there, otherwise at T.



273. End to End Splice (Braid)

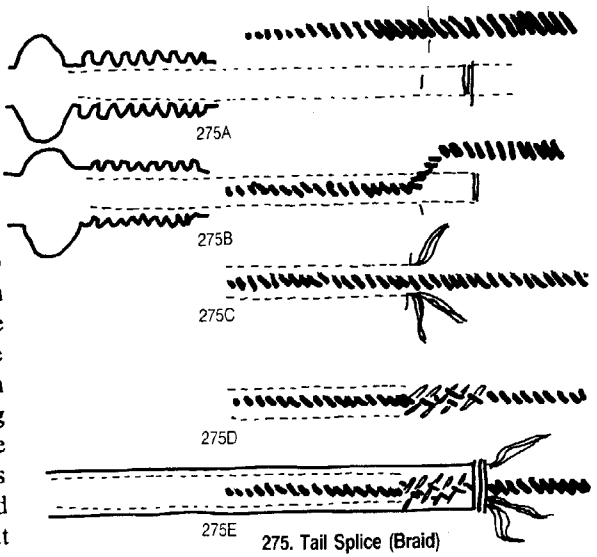
For the **End to End Splice (273)** mark each end I, II and III at 1, 2 and 3¼ fid lengths from the end. Taper the ends from I as in 272 so that when taped it is a good fit in the hollow fid. Insert one end into the other at II, exiting at III, pulling it through until its mark II is nearly absorbed (273B). Then repeat with the second rope (273C). Work the ends until the lock tuck is as small as possible, trim off the ends and tuck them back into the rope and milk the ropes smooth. This splice is very similar in structure to 271.

The next two splices are applicable to many core and sheath ropes, the main requirements being that the sheath can be readily retracted off the core, maybe after a little handling, and that the core remains coherent through the manipulations; with some constructions a little ingenuity may be needed to apply the principles.



274. Tapering Splice

The **Tapering Splice (274)** unites two ropes of different diameters; the smaller rope should be equal to or only slightly thinner than the core of the thicker rope, but need not itself be of core and sheath construction, though it must not be hollow plait. The rope should not be subject to tight clamping in the region of the splice. Tie a knot such as a Slip Overhand (64) about 200 rope diameters back from the end of the larger rope. Tape the end of the sheath and slide it back from the core; cut off 25–30 rope diameters of the core (274A); a short whipping may be needed. Butt the thinner rope against the core. If both are of the same synthetic it may be possible to fuse them together, maintaining the same diameter; this can be tricky and a bit of practice is desirable. In any case, sew the two ends together securely (15; 274B). Return the sheath, using a milking action to smooth it over its core and the thinner rope. Place a small whipping (Palm and Needle, 14, or West Country, 13) a couple of rope diameters back from the end of the sheath; taper the sheath by cutting and withdrawing strands of varying lengths. Cover the whole of the tapered sheath with a firm whipping (274C); the Palm and Needle is usually best.



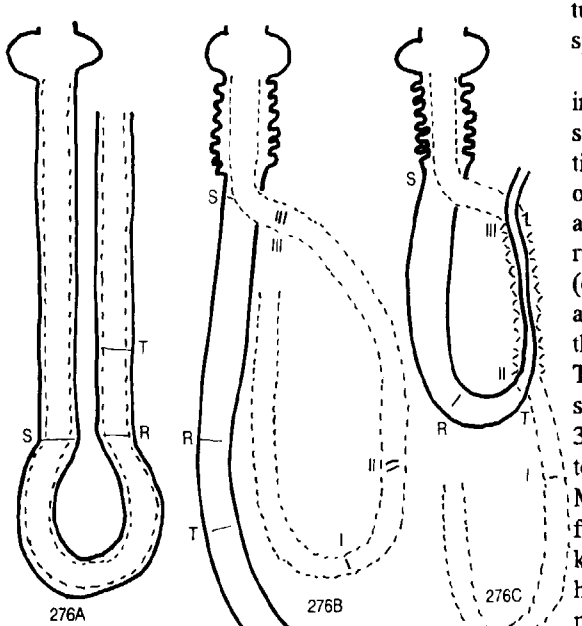
275. Tail Splice (Braid)

The **Tail Splice (275)** joins a wire halyard to a core and sheath rope of about double its diameter. Tie a knot such as a Slip Overhand (64) about 200 rope diameters (all measurements refer to the core and sheath rope) back from the end of the rope. Tape the end of the sheath and slide it back along the core. Tape the core about 15 rope diameters back from the end and cut off the surplus; put a mark I at about another 15 rope diameters back. Mark the wire at about 50 rope diameters back from the end; it may be desirable to taper the last few rope diameters of the end, cutting and withdrawing strands at different lengths, taking care to avoid cut wire ends sticking up, and tape the end of the wire (275A). Insert the wire into the middle of the core at the mark I until the mark on the wire is reached (275B). This is straightforward if the core is braided; if the core is 3–strand laid, it is simple to have its strands re–laid around the wire; other constructions of the core may need ingenuity. Tape the core enclosing the wire firmly at the mark I and unravel the ends, arranging into three groups with taped ends (275C). Use these as strands to splice into the wire, over and under two strands at a time as in the laid rope Tail Splice (262). Make three tucks with the full strands, halve them and make a final tuck with the half strand (275D); the groups of core fibres can be allowed to spread out flat. Trim off the ends and pass through a flame to fuse the ends, but take care not to melt the whole rope. Return the sheath and smooth it out to its full length over the splice with a milking action. Make a tight West Country Whipping (13) at the end of the splice. Unravel the end of the sheath and divide into three groups with taped ends as before (275E). Splice these into the wire as before, making two tucks with the full strands and three tucks with progressively tapered strands. Trim off and pass through a flame as before.

Double Braid Ropes

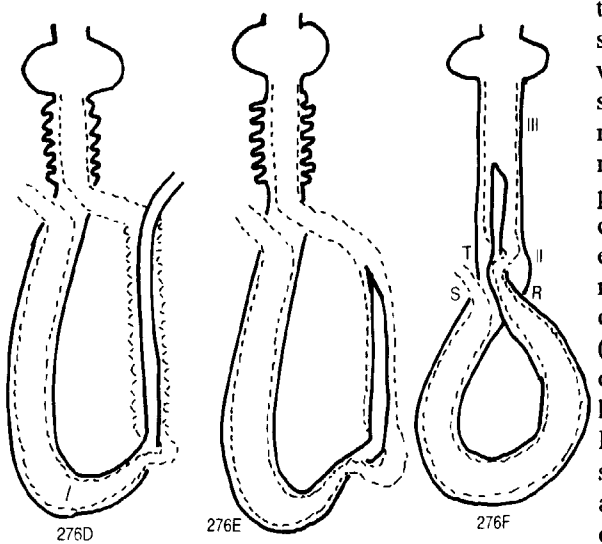
The remaining splices are specific to double braid rope. If you are splicing

used or particularly hard rope, you should soak it in warm (not hot) water for a few minutes; you may also need considerable force to make some of the tucks at the end of the splice.



276. Eye Splice (Double Braid)

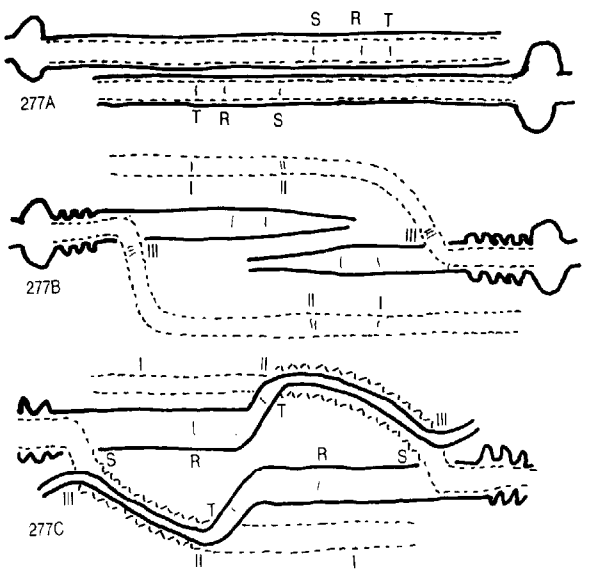
The **Eye Splice (276)** in double braid rope is suitable only in application 245D. Tape the end of the sheath and mark R at 1 fid length from the running end; form the eye (over the thimble if used) and mark S across the throat from R. Mark also T, 10 of the double strands in the plait (about 3 rope diameters) from R towards the end (276A). Measure 5 fid lengths from R and there tie a knot such as a Slip Overhand (64) to prevent too much disturbance of the sheath to core relation. It is sometimes convenient to fasten this knot to a secure point to pull on when working the splice. Open up the mesh at mark S and mark the core I at that point. Withdraw the core from S, taping its end, then withdrawing more of the core, concertinaing the sheath (compressing it like a concertina) towards the knot to allow this. Mark the core II one short fid length from I and III one full plus one short fid length from II (276B). Using



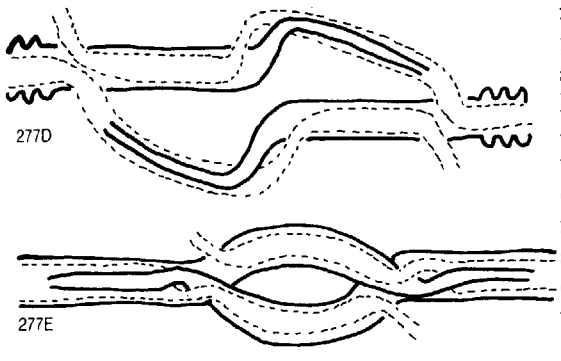
276. Eye Splice (Double Braid)

the hollow fid, insert the sheath into the core at II, exiting at III, bunching up the core so that point T is just at II (276C). Then insert the core into the sheath at T. leaving it through the same hole S that the core left (shown opposite in 276D for clarity). Pull the core and sheath ends against the crossover point T to lock the two together. Remove the tape from the end of the sheath and unravel as much as you can reach, and taper by removing strands at varying lengths. Holding at the crossover point to ensure it does not slip, smooth out the rope on either side; the tapered sheath will slip into the core (276E). Still holding the crossover point, smooth the sheath down from the knot and over the exposed core, using a milking action. Difficulties may be due to internal twists or kinks which need smoothing out by rolling and flexing the rope. The crossover point should be absorbed into the standing part (276F). Insert the thimble and continue to smooth out the sheath as you tighten the eye. Trim off the protruding core at S at a length of 5–10 mm, and tuck this inside the sheath, smoothing out again. Place a Palm and Needle Whipping (14) at the throat, passing some of the stitches through the middle of the rope.

The End to End Splice (277) is started by taping the end of each rope and measuring about 6 fid lengths back; there tie a knot such as a Slip Overhand (64). Mark R at 1 fid length from the end and S at 1 short fid length from R, then T at 7 of the double strands in the plait (around 2 rope diameters) towards the end (277A). A sort of Cut Splice (245H) can be made by making the distance RS a bit longer. Open up the plait at S, exposing the core which should be marked I. Withdraw the core and concertina the sheath to allow marking the core II one short fid length further back and III at one full plus one short fid length further back again (277B). Working from T in a straight line towards the end, mark five alternate clockwise strand pairs, and also five alternate anticlockwise strand pairs; remove the tape from the end, cut and remove the marked strands, thereby giving an even taper. Retape the end and use the hollow fid to insert each sheath end into the core at II, exiting at III, with the mark T on the sheath against III on the core, bunching the core as

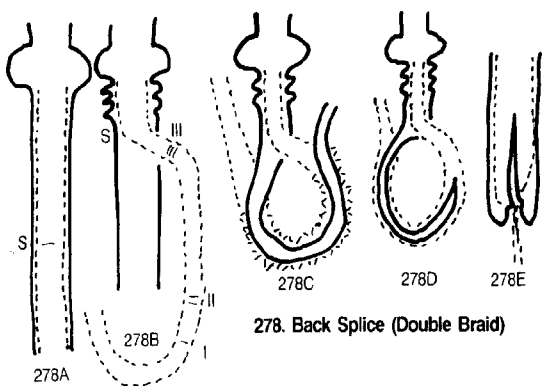


277. End to End Splice (Double Braid)



277. End to End Splice (Double Braid)

needed (277C). Then insert the core into the sheath at T and out at S. Pull on the ends of the core and sheath, working the splice to tighten the crossovers at T; then remove the tape from the sheaths and hold the crossover while relaxing the core so that the sheath is withdrawn into the core (277D). Hold the crossover point and work the sheath down from the knot over the exposed sheath, using a milking action. Continue until the crossovers are absorbed into the main sheath (277E); it may help to roll the splice between the hands and pound the splice with a wooden mallet. Cut off the protruding core ends at S and tuck into the sheath. There will be a small gap between the two ropes at the join; this could be made larger if wanted by using a longer RS distance.



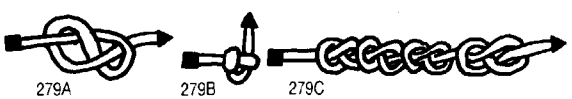
278. Back Splice (Double Braid)

A Back Splice (278) can be made in a similar fashion. Tape the end of the sheath and tie a knot such as a Slip Overhand (64) about 5 fid lengths from the end. Mark the sheath S at 1 fid length (278A), Expose the core at S and mark it I, then pull the core out, concertinaing the sheath so that the core can be marked II at 1 short fid length from I and III at 1 fid length plus 1 short fid length from II (278B). Using the hollow fid, insert the sheath into the core at II and out at III, bunching the core as needed to allow mark II to be as close to S as possible (278C). Pull the end of the sheath out of the core and taper by cutting out strands at varying lengths, then re-lay the core so that the sheath is absorbed (278D). Work the main sheath down from the knot over the core with a milking action until the original point S has been absorbed (278E). Cut off and heat seal the extruding core.

Chapter 14
FIGURE EIGHT KNOTS

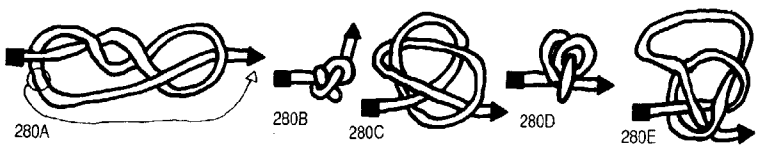
The knots in this section are based on simple and multiple Figure Eight Knots and can be seen to have analogues with simple and multiple Overhand Knots; similarly there are multiple forms for most of the simple Figure Eight applications. Only a few of these analogues are discussed here, mainly those most commonly used, but they exemplify how analogues are formed. In general the Figure Eight forms are a little more secure and a little less likely to jam than the corresponding Overhand forms.

SIMPLE FIGURE EIGHTS



279. Figure Eight Knot

The **Figure Eight Knot (279)** is a bit more bulky and a bit less likely to jam tight than the Overhand Knot (58). It may be tightened by pulling on both ends (279A), which is more decorative, or by pulling on the standing part against the knot (279B), which is more bulky, a better stopper knot. A series of Figure Eights worked tight so that they overlap (279C) makes a decorative single-strand lanyard knot, but the knots tend to separate if under heavy load.



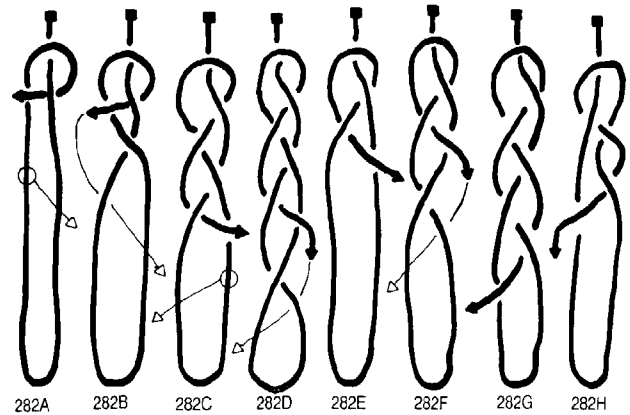
280. Figure Nine Knot

The **Figure Nine Knot (280)** is similar to 279 but a little more secure and a little bulkier (280B). It is readily converted to a much bulkier stopper knot (280D) which has been used as a bead knot. This can be made by moving the standing loop towards the running end as indicated on 280A and bringing the ends close together to get the knot into the form in 280C before tightening. Care is needed to avoid kinks and it is usually easier to tie the knot by making an Overhand Knot (58) and passing the running end around the belly of the knot and into the standing space (280E). This is an interesting example of the relation between Figure Eight and Overhand Knots.

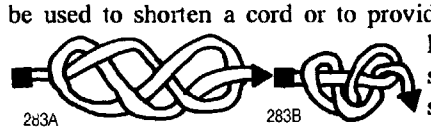
281. Stevedore Knot

The **Stevedore Knot (281)** is a little bulkier again (281B) and a little easier to untie.

There are few circumstances in which it is worth while to extend the series Figure Eight–Figure Nine–Stevedore very much further. But the **Single-Strand Threefold Plait (282)** which has the Figure Eight Knot as a special case (282E) can be considered here. Depending on the exact number of bights wanted on either side, you need to start as 282A (which gives 1,2; 3,3; 4,5; 6,6... bights on the right and left sides respectively); 282E (which gives 2,2; 3,4; 5,5; 6,7...bights) or 282H (which gives 2,3; 4,4; 5,6; 7,7...bights), which are actually the Overhand, Figure Eight and Figure Nine Knots respectively. Starting from 282A or 282E gives a more regular form. After the start, all work in the same way; you have the running end out to one side (A, C, E, G, H); twist the bight (B, D, F) and insert the running end across the plait (C, G), remembering that all strands follow an over one under one pattern. Aside from decorative uses, the plait can be used to shorten a cord or to provide a less uncomfortable seat in a chair knot. The **Sennit Knot (283)** is the stage 282C. It is quite attractive as a single-strand lanyard knot (283A) and quite bulky as a stopper knot (283B).

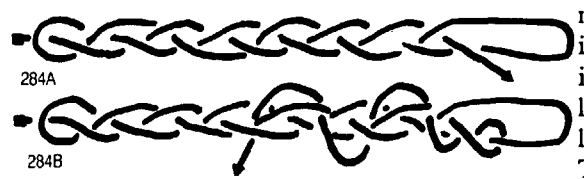


282. Single-Strand Threefold Plait



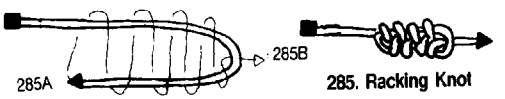
283. Sennit Knot

The **Double Tie (284)** is used to make the "double" used in big game fishing: this is a long (up to 10 m) loop in, usually, braided line. A Single-Strand Threefold Plait (282) is made to give 10–20 bights on each side (284A). The running end then makes a half hitch and is tucked back through the plait for about a third of its length (284B) and the knot worked tight.



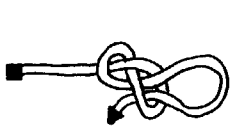
284. Double Tie

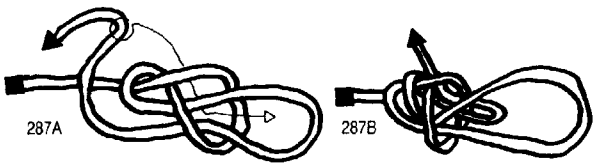
The Racking Knot (285) makes a long, bulky stopper knot providing a bit of weight on the end of a cord. Make a loop (285A) and snake the running end back round the loop (285B).



285. Racking Knot

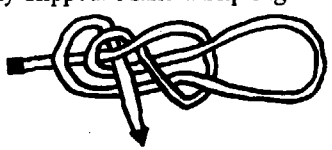
FIGURE EIGHT SLIPPED LOOPS AND NOOSES


286. Slip Figure Eight Knot

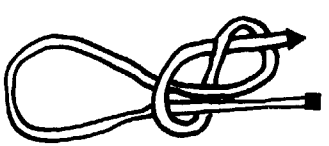


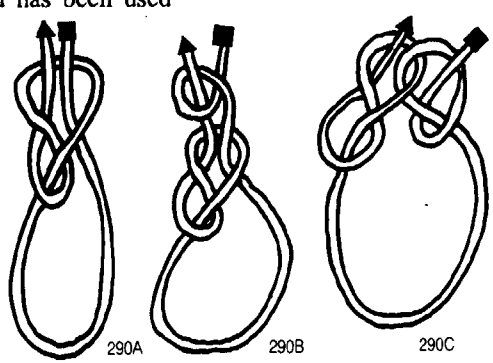
287. Slip-Tucked Figure Eight Loop

The **Slip Figure Eight Knot (286)** is a quick-release form. Like the Slip Overhand (65–70), this loop can be converted into a standing eye in several ways, but only two are given here. The **Slip-Tucked Single Figure Eight Loop (287)** is quite a firm loop that can be readily slipped. Make a Slip Figure Eight (287A) and pass a bight of the running end into the running space (287B). Another firm loop is the **Rover Knot (288)**, tied by making a Half Hitch with the running end of a Slip Figure Eight Knot and passing into the standing space as shown.


288. Rover Knot

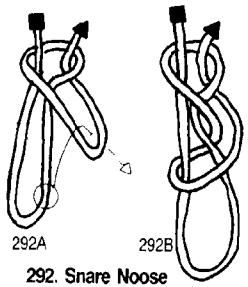
Several nooses can be made from the Figure Eight. The **Standing Figure Eight Noose (289)** keeps the Figure Eight Knot loose at all times. The **Running Figure Eight Noose** or **Butchers Knot (290A)** holds well if made in rough cord round a compressible object and has been used round corned beef etc while it shrinks in brine, but it will not withstand much handling. If you cast a Half Hitch in the standing part round the running end (290B) it makes a firm binding knot. If the standing part is to be used for further binding, it is best to cast the half hitch around its immediate standing part (290C).


289. Standing Figure Eight Noose



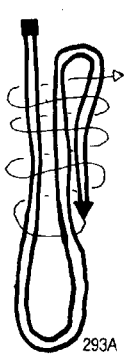
290. Running Figure Eight Noose

291. Crossed Figure Eight Noose

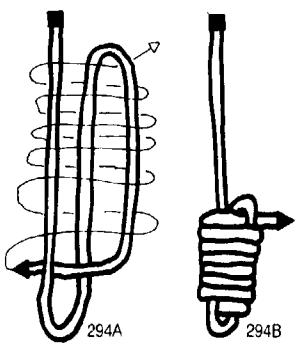


292. Snare Noose

However, the **Crossed Figure Eight Noose (291)** has the standing part enclosed in two turns of the Figure Eight and the running end crossed against the standing part and has more friction and a better grip.The **Snare Noose (292)** has even more friction and makes a good snare. It can be tied direct as a Figure Nine (280) noose or as shown starting with an Overhand Noose (77; 292A), passing the loop through the standing space (292B).



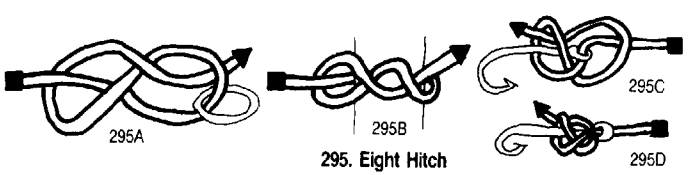
293. Hangmans Noose



294. Hanging Heaving Line Knot

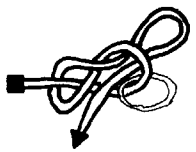
The **Hangmans Noose (293)** was apparently originally used for the purpose indicated by its name; it also forms a decorative eye. It can be considered a multi-turn Figure Eight noose with the turns transferred to the outside of the knot. Make a long S-bend (293A) and wrap the running end back round all three cords the necessary number of turns; pass the end through the top bight and pull tight on the bottom bight (293B). A minor modification makes the **Hanging Heaving Line Knot (294)**, a soft weight on the end of a line for throwing some distance. Make the S-bend as in 293A, but pass the running end through the bight (294A) before making the turns (294B). Tighten by first pulling on the bottom bight and working tight, then pull on the standing part.

FIGURE EIGHT KNOTS ROUND AN OBJECT



295. Eight Hitch

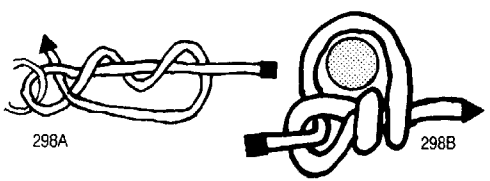
The **Eight Hitch (295)**, more secure than a Half Hitch, holds well when tied as 295A round thin objects, no thicker than the cordage. Larger objects may have the knot tied as in 295B, with the running end trapped against the object. Tied as in 295C, tightened as 295D, it used to be used with gut lines on


296. Slip Eight Hitch

297. Nine Knot

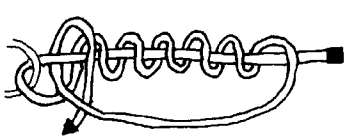
angle-eyed fishing hooks, but had the reputation of becoming insecure during a long fight. The **Slip Eight Hitch (296)** is a handy quick-release knot for fastening a rope to an object, more secure than a Slippery Hitch (334).

The **Nine Knot (297)** is a more secure attachment to a hook. It is based on the Figure Nine Knot (280), with the shank of the hook incorporated within the turns. Pass the running end of the line through the eye and make a Half Hitch around the shank (297A); then pass the end back round the standing part and return under itself and through the Half Hitch (297B). Tighten with the back loop over the eye (297C).

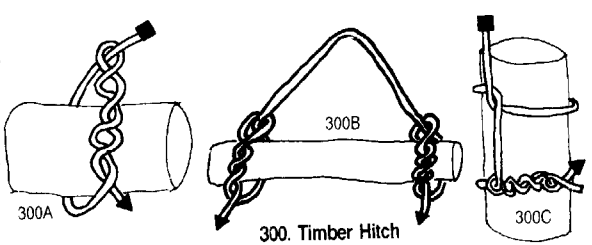


298. Stevedore Hitch

The **Stevedore Hitch (298)** is more secure than the Eight Hitch (295); like it, it may be tied to a thin object as 298A, or, tied as 298B, with a toggle, not much bigger in diameter than the rope, between the twists and the bight of the running end of a Stevedore Knot (281), it gives a more secure pull than a Lever Hitch (91).

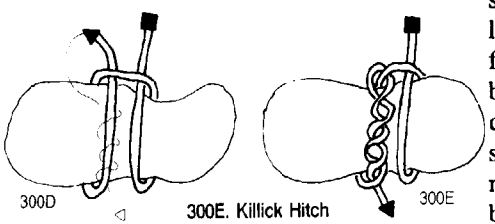

299. Clinch Knot

The **Clinch Knot (299)** is a good knot to join a fishing line to a hook; in thin line it may be tied in the bight; it is a multiple Eight Hitch (295) (at least five turns are recommended) with the running end clinched back into the returning loop.

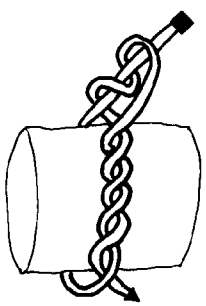


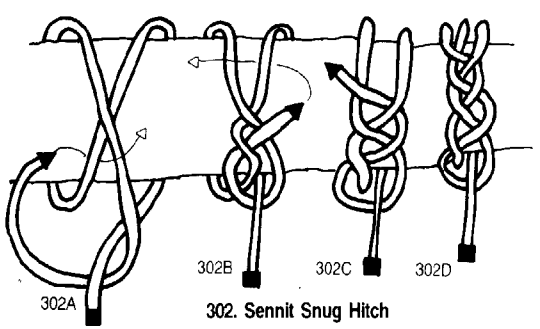
300. Timber Hitch

The **Timber Hitch (300)** is used for towing or hoisting timber or other longish cylindrical objects on end; if sufficiently rough, several poles can be handled at once; it is also used to start some lashings (see later). Two Timber Hitches can be used on either end of a rope to lift timber horizontally (300B). It cannot jam and is easily released. Pass the rope round the pole, make a Half Hitch round the standing part and twist the running end with the standing part, preferably with the lay of the rope, at least three times. For short poles, a simple Timber Hitch well above the centre of gravity should



suffice, but longer loads, specially if the lift is vertical, should, for better control, have the Timber Hitch placed a little below the centre of gravity and one or two spread out Half Hitches placed nearer the tip (300C). This combination is known as a **Killick Hitch** which is also used to tie a rope to a rock or other object as an emergency anchor or killick. It may be tied as above or by making a Cow Hitch (379; 300D) and then twisting the running end with its own standing part (300E). The **Double Timber Hitch (301)** is a little stronger and less liable to chafe than the Timber Hitch, though if the load has to be dragged through vegetation etc., a little more liable to catch on obstructions. Instead of the initial Half Hitch, make a round turn round the standing part, then bring the running end back and twist as before.


301. Double Timber Hitch



302. Sennit Snug Hitch

The **Sennit Snug Hitch (302)** is a decorative snug hitch to a spar that can, if desired, be continued as a plait right round the spar (302D). Make a riding turn round the spar (302A) and continue interweaving (302B) as in a Single-Strand Threefold Plait (282). For any security, the running end must make at least two tucks (302C), but more can be made (302D).

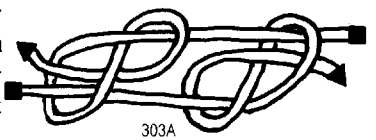
ADJACENT, INTERLOCKING AND CONGRUENT FIGURE EIGHTS

Again, this is a series very like the Overhand Knot series in Chapter 9.

Adjacent Figure Eights

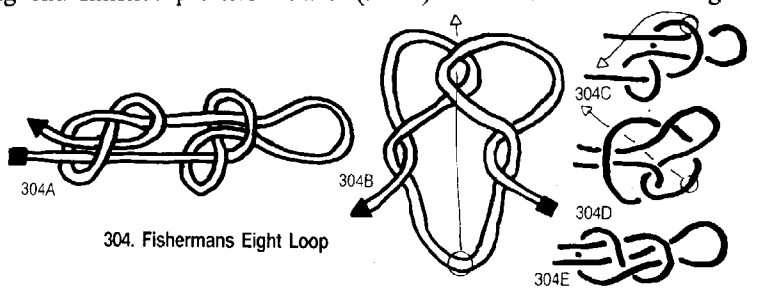
The **Fishermans Eight Knot (303)** uses Figure Eight Knots instead of the Overhands of the Fishermans Knot (103). It may not be very satisfactory in fishing line but works well in rope, including ropes of moderately unequal thickness. The Figure Eights should be tied so that their running ends are

parallel to the standing parts of the other rope; if in making the first Figure Eight you pass under the standing party of the other rope, then pass under the first standing part to start the knot (303A); work tight (303B).



303. Fishermans Eight Knot

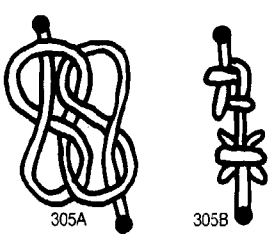
The **Fishermans Eight Loop (304)** is a good loop that is easier to untie after heavy load than the Fishermans Loop (104). It can be tied by making a Figure Eight in the standing part, forming the loop (perhaps round an object) and taking the running end through the Figure Eight parallel with itself and tying another Figure Eight round the standing part so that the running end finishes parallel with it (304A). It can be tied in the bight by



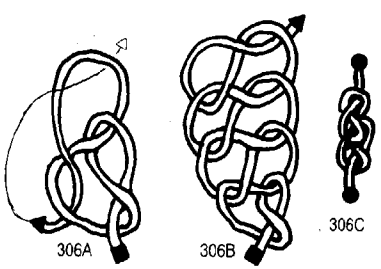
304. Fishermans Eight Loop

making two complete turns of opposite handedness at each end of a bight a bit longer than is needed for the loop (304B), then pass the bight through the eye so formed; as you pull it through, pass the outer knot over the inner. Sometimes instead of the form of 304A, one or more of the Figure Eights will be the wrong way round; this may be corrected as shown in 304C–E.

Interlocking Figure Eights



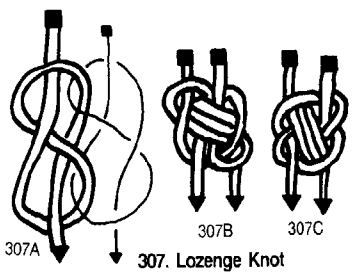
305. Conjoint Figure Eight Knot



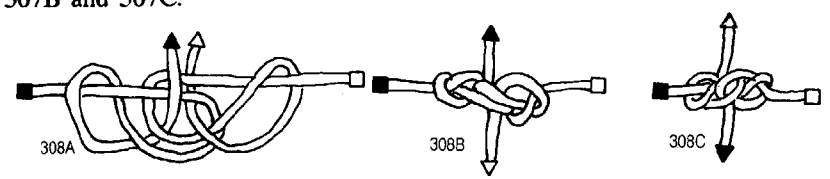
306. Double Chain Sennit

The **Conjoint Figure Eight Knot (305)** is a single strand lanyard knot. It consists of two Figure Eight Knots of alternate handedness sharing adjacent loops. The construction is shown in 305A, and the appearance of the two sides after tightening in 305B and 305C. If extra Figure Eights are worked into 305 a chain results; however, the common **Double Chain Sennit (306)** has all the

Figure Eights of the same handedness and so is easier to make. Tie a Figure Eight Knot and pass the running end back through the last-formed loop of the knot (306A) and then up through the last loop so formed and so on (306B) for the desired length. Unlike the Chain Sennit (75), this knot will not slip undone; each turn must be untied. If the first two stages of the Double Chain Sennit are tightened, another single strand lanyard knot (306C) is formed. The **Lozenge Knot (307)** is a two-strand lanyard knot. Each strand forms a Figure Eight Knot (307A) interlinked in a way similar to the Double Chain Sennit (306). The two sides of the completed knot are shown in 307B and 307C.



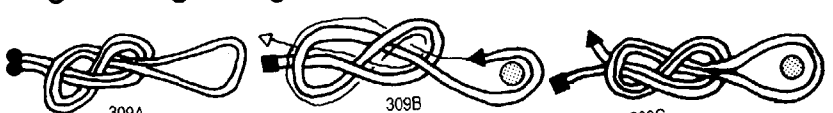
307. Lozenge Knot



308. Riggers Eight Bend

The **Riggers Eight Bend (308)** is the analogue of the Riggers Bend (128). It is strong and secure, and easily untied. Make a Figure Eight Knot (279) in one rope and interweave into it another Figure Eight (308A); the two sides of the finished knot are shown in 308B and 308C.

Congruent Figure Eights

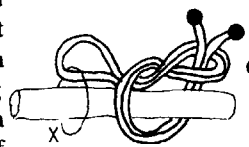


309. Figure Eight Loop

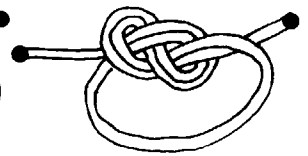
The **Figure Eight Loop (309)** makes a secure loop in the running end; tied in stiff kernmantle ropes it works well where a Bowline fails. It is not secure with a three-way pull. It may be tied simply as a Figure Eight in the bight (309A). If made with a small loop and short running end and pulled tight as in 279B it forms a particularly bulky stopper knot. To tie the loop round an object, make a Figure Eight Knot in the standing part (309B) take the end round the object and follow through (309C). In making the Figure Eight Loop it is best if the standing part takes the outer curve next to the loop; or in following through in 309B, the running end takes the outer curve at the standing part end. This puts most load on the wider curve and makes a stronger knot, particularly in laid and softer braided ropes.

An Eight Hitch (295B) or Stevedore Hitch (298B) if tied in the bight form

an **Anchor Hitch (310)**, used to tie a line to an anchor. It has also been used to tie a bight or end of a climbing rope to a waist length of a climber; the running end of the bight is then fastened to the waist length with a karabiner at X (310).

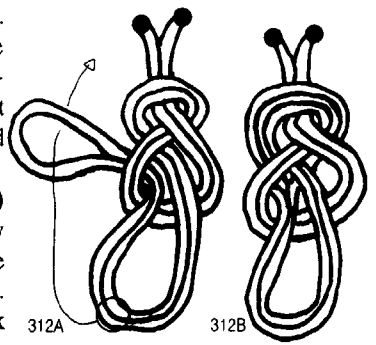


310. Anchor Hitch


311. Figure Eight Back Loop

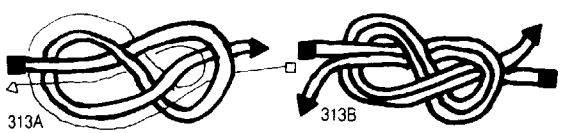
The **Figure Eight Back Loop (311)**, made by the follow-through method, is the analogy of the Overhand Back Loop (136); it holds a three-way pull well but is not good for a pull on one end against the loop.

The **Figure Eight Double Loop (312)** forms a secure double loop with a narrow neck; it is readily untied. Make a Slip Figure Eight (286) in the bight of the rope (312A). Pass the loops through the bight and work the bight up parallel to the upper turns of the Figure Eight (312B).

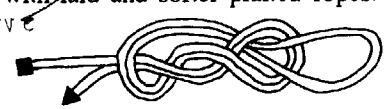


312. Figure Eight Double Loop

The **Flemish Bend (313)** is a strong and secure bend, though a little fussy to make; it has been used by some mountaineers to join two nylon climbing ropes, sometimes further secured with Overhand (58) or Grapevine (62F) Knots in the running ends round the adjacent standing parts; the knot would also be more secure, and less liable to jam, than the Tape Knot (132) to join two straps or tapes. Again, it is best to have the first major bend of each standing part to be on the outside, as shown, particularly with laid and softer plaited ropes.



313. Flemish Bend


314. Figure Nine Loop

315. Stevedore Loop

The **Figure Nine Loop (314)** and the **Stevedore Loop (315)** give greater security than the Figure Eight Loop (309); if subjected to a shock load the turns slip a little before gripping, absorbing some of the shock; the Figure Nine Loop has been used as shock absorber when cavers tie on to the main rope.

316. Twisted Loop

317. Sennit Loop

Both knots have also been tied in fishing line to make leader or dropper loops; for leader loops or sea traces etc in nylon lines, it is best to have at least four turns, as a **Twisted Loop (316)**. Alternatively, a **Sennit Loop (317)** would give greater security, using a Sennit Knot (283) or longer form of the Single Strand Threefold Plait (282).

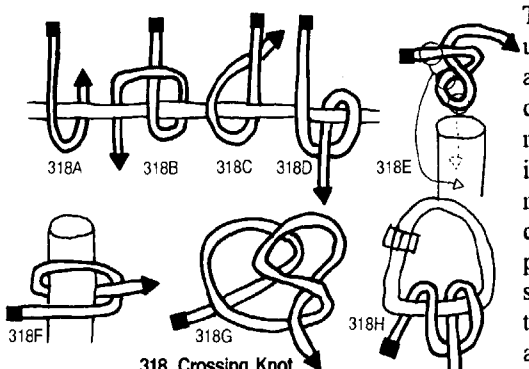
PART THREE

KNOTS WITH CONCENTRATED NIP

This Part deals with knots whose nip is more concentrated at particular points, often by a rope pressing on its own near standing part, though there are often places of more distributed friction as well. It may at times be difficult to decide which element is the critical one. Most of the knots discussed in this Part fall into well-defined groups. However, there are others with interesting structures that do not fall into those groups; some of the most useful are discussed here.

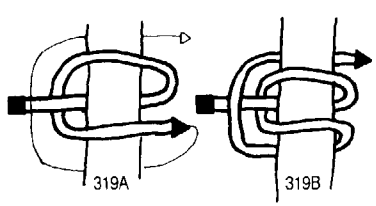
Chapter 15
KNOTS WITH A SIMPLE NIP

KNOTS WITH A SIMPLE NIP TIED IN A SINGLE ROPE



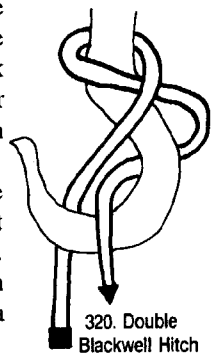
318. Crossing Knot

The **Crossing Knot (318)** is used as a light fastening where a rope or cord crosses another cylindrical object at about a right angle. In tying up parcels it is most secure to pass the running end over the other cord and back under it (318A), pull tight then pass it across its standing part and back under the cord (318B). It is faster and easier to pass the running end under and round the cord and back under the standing part (318C), pull tight first back towards the standing part and then forwards, when the riding turn transfers forwards (318D). You can make a rope fence, when the tops of the posts are in reach, by making a twisted loop (318E) and passing it over the post (318F). Climbers have used the same knot round a karabiner as an aid in belaying. Make a simple and a twisted turn of the same handedness (318G) with the running end made fast to the climber and the standing part to an anchorage. Clip in a karabiner (318H) which is itself anchored to the belayer or another anchorage. The rope can easily be fed to the climber as he or she moves away, at the cost of some abrasion of the rope, but if the climber falls the knot provides a lot of friction; when pulling the rope in as the climber approaches, the riding turn transfers to the other side of the karabiner. Climbers sometimes call this knot an **Italian Hitch**. For heavier ropes and wider posts, a more secure form is the **Zigzag Knot (319)**. Make a Crossing Knot in the 318D form (319A) and then pass the running end back under the post, over the standing part and under the post again (319B).

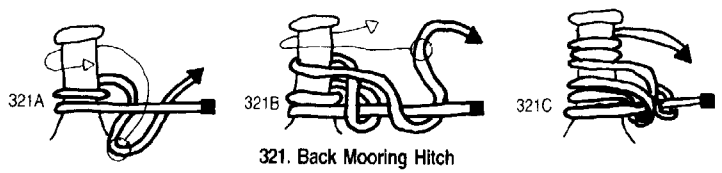


319. Zigzag Knot

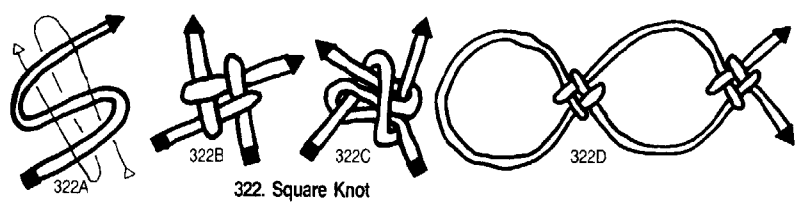
The **Double Blackwall Hitch (320)** gives considerable security for attaching a rope or chain to a hook when the load is steady, but allows instant release when the load is slacked off. Note that the standing part crosses the running end twice, once at the back of the hook and once in its mouth. The hook must be properly engineered and of an appropriate size for the knot to hold in rope, and even then may not hold with slippery synthetics.


320. Double Blackwell Hitch

The **Back Mooring Hitch (321)** is a strong and secure hitch for mooring or for towing heavy loads where it might be necessary in emergencies to release the load rapidly. Take a round turn round the towing post (with a rough post and rope a simple turn may be adequate), then pass a bight of the running end under the standing part (321A) and over the post. Repeat from the other side (321B) and again as many times as may be needed. Finish with a few round turns on top of all (321C). If the load is to be left tied up for some time, and no emergency release will be wanted, make one or two Half hitches around the standing part.

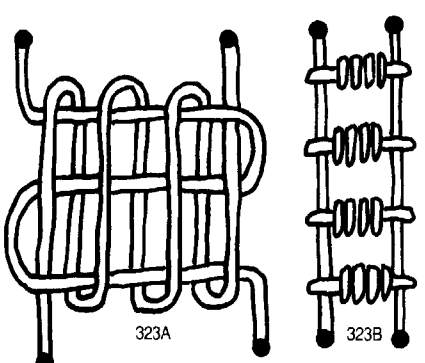


321. Back Mooring Hitch



322. Square Knot

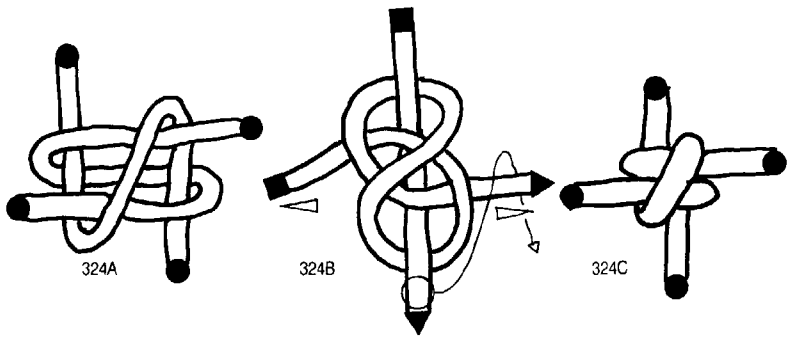
The **Square Knot (322)** is a decorative bend that can be used as a crossing knot or a lanyard knot. Make an S-bend in one cord (or in a bight of the cord to be crossed) (322A). Pass the other cord through it in a matching S-bend (322B; the other side is shown in 322C). As a two-strand lanyard knot (322D) the legs are bowed out. Probably the most successful ladder made entirely in rope uses the **Ladder Knot (323)**. This is a multi-turn Square Knot (323A); the number of turns depends on the size of the rope; probably 4–8 turns will be needed (323B), but too



323. Ladder Knot

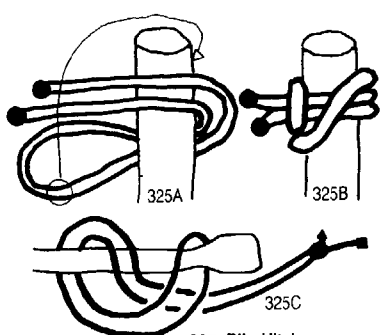
many will allow the rungs to sag too much.

The **Reciprocal Crossing Knot (324)** is very similar to the Square Knot (322); it is more secure as a crossing knot but perhaps a little less decorative.



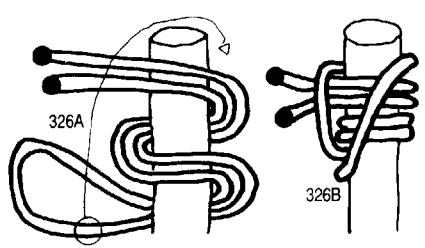
324. Reciprocal Crossing Knot

It is particularly suitable to square netting, indeed it has been used in wire mesh fences. It can be tied direct (324A) in a similar way to 322A, or it can be tied by making a Constrictor Knot (150) with, usually, the horizontal cord on the vertical one (324B). Capsize the Constrictor; the running end of the vertical cord will flick over the horizontal, forming 324C when tightened; this last method has been mechanised.



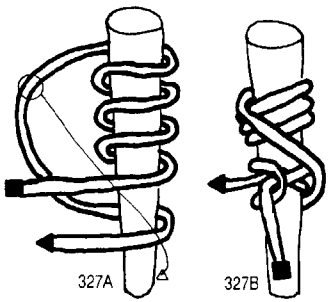
325. Pile Hitch

Another versatile knot is the **Pile Hitch (325)**. It can be used to tie up a boat or an animal, as a towing hitch in the bows of the boat being towed; as a crossing knot, specially on a fence; as a bottle knot if the ends are joined or the knot tied in a sling; or for tying a leader loop to a blind or flatted hook (325C). Take a bight round the pole or whatever, taking it below the standing part (325A); pass it across the standing parts and over the pole (325B). Leave plenty of tail to the knot when tying close to the running end as sometimes there is an initial slip. For greater security, use a **Double Pile Hitch (326)**. If the rope and spar are not too slippery, the hitch may also be used for a lengthwise pull, including lifting a spar on end. Make a complete round turn with the bight (326A) and pass the loop over the top of the pole (326B).



326. Double Pile Hitch

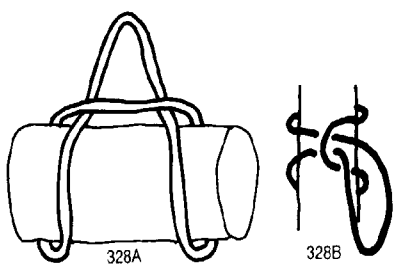
The **Icicle Hitch (327)** will take a reasonable pull along a taper of a smoothish spar, perhaps even an icicle if the taper is not too great and if time is allowed for the rope under pressure to melt into the ice. Make at least three round turns away from the point; more turns are needed if rope and spar are particularly smooth or if the taper is more than very gradual. Then pass the running end behind the standing part and over the tip of the spar in the opposite direction (327A). Pass the bight across the standing part and the running end and over the tip (327B). Work well tight before loading. Note that the knot comes off very quickly once it does start slipping on a taper.



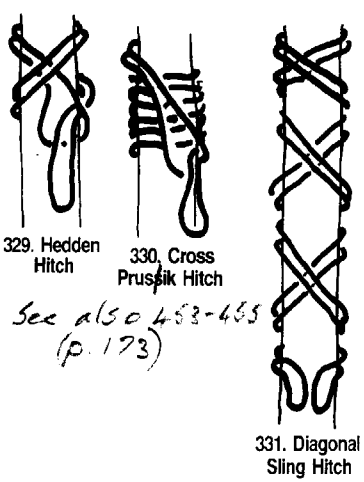
327. Icicle Hitch

KNOTS WITH A SIMPLE NIP TIED IN A SLING

The **Bale Sling Hitch (328)** is used to attach a sling to a bale or other object for lifting (328A) (a Catspaw (50) is needed to attach to a hook); or to a spar for a vertical pull (328B), provided the rope and the spar are rough or the load light. Greater security can be obtained by making an extra turn or two with the sling, with the standing part beneath the running end to make a **Hedden Hitch (329)**; this has been used by climbers for a vertical ascent on a rope with a sling of rope about half the diameter of the climbing rope, since the knot will take a good load on the running end but can still be moved along the main rope when unladen. The **Cross Prusik Hitch (330)** has the standing part of the sling on the outside of the turns and so is not as secure as 329, so more turns are needed; maybe six or so for attaching a sling to a spar to hold either the top block of a tackle or a hook for a vertical lift. Climbers use about three turns for a similar application as the Hedden Hitch (329); it can be tied one-handed. The **Diagonal Sling Hitch (331)** is more secure again for attaching to a spar. It may be an advantage to have the two legs of the sling crossing alternately over and under each other. Though it is possible to attach the hook to the running end of the sling after passing it through the standing part as in 328–330,



328. Bale Sling Hitch

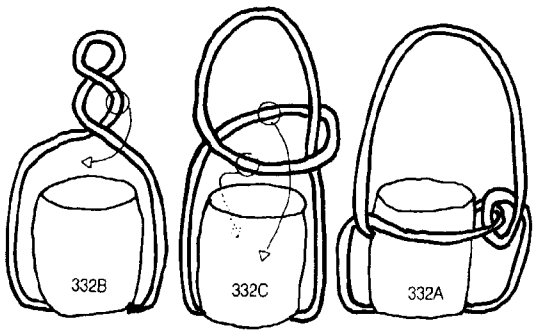


329. Hedden Hitch

330. Cross Prusik Hitch

331. Diagonal Sling Hitch

See also 453-455 (p. 173)



332. Cask Sling

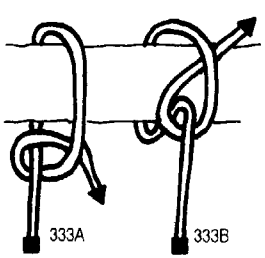
greater strength is obtained by putting the hook in both bights, adjusting the distance apart of the turns to allow a tight fit of the hook in the two bights.

The **Cask Sling (332)** does with a sling what the Barrel Sling (197) does with a single rope, raise a cask on end. Place the cask over the sling and put a twist in the bight above it (332A). Open out the loop (332B) and work it down over the cask (332C); it must be above the centre of gravity.

Chapter 16
HALF AND SINGLE HITCHES

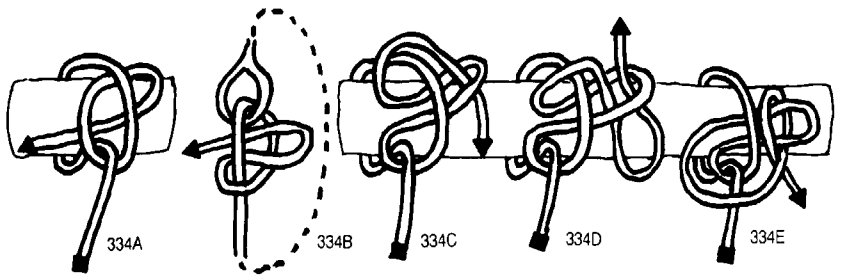
When a rope passes round an object, half hitches may be made with the running end around the standing part on the other side of the object, or single hitches may be made direct around the object, which in this case may indeed be part of the same rope. In most of the knots all the hitches are tied in the same direction, but sometimes there is a reversal.

HALF HITCHES ON THE STANDING PART



333. Half Hitch

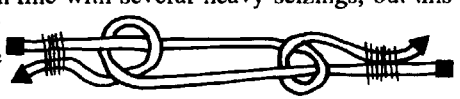
The simplest form of the **Half Hitch (333)** is shown in 333A. It slips readily unless tied in very rough rope, but is has two applications: tied in the running end of some other knot (e.g. Clove Hitch, Bowline or Reef Knot) for security, when the knot takes the place of the spar in 333A; or as a prelude to some extra way of preventing slipping, such as a Seizing or another Half Hitch. However, if the running end is trapped against the object being bound (333B), it will take a moderate steady load.

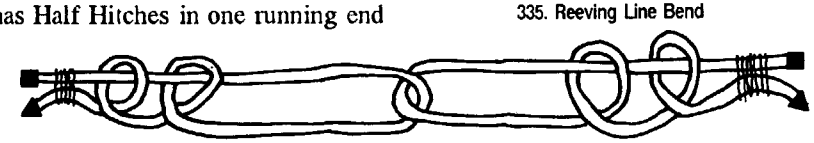


334. Slippery Hitch

The **Slippery Hitch (334)** is possibly a little more secure than the Half Hitch and is often used to suspend objects from a beam. In the form 334B it is a handy quick-release binding knot for a snotter. Greater security can be obtained by tucking the running end into the bight (334C); the quick-release feature can be retained by tucking a bight instead (334D); in both cases, keep the initial bight small. Another way of securing the Slippery Hitch is by casting a Half Hitch in the running end round the bight (334E).

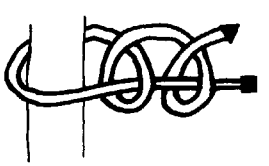
Bending together two heavy hawsers raises two problems: many ordinary bends become very difficult to untie in the heavy rope and they tend to jam if passing round a bollard or through a hawsehole. In extreme cases the two hawsers have been seized together in line with several heavy seizings, but this is both troublesome and not very strong. Alternatives include the **Reeving Line Bend (335)**, which has Half Hitches in one running end


335. Reeving Line Bend

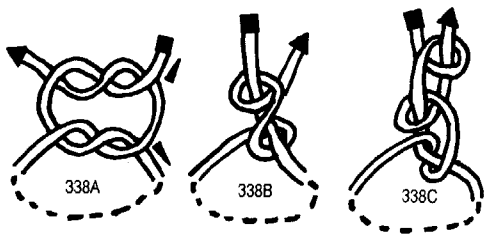

336. Hawser Bend

around the other standing part and has the same form as the Grass Knot (163); and the more secure **Hawser Bend (336)** which has two Half Hitches in the running ends around their own standing parts. In both knots the Half Hitches should be kept well apart and worked tight before applying firm seizings.

Two Half Hitches (337) fasten a rope to an object such as a spar, picket etc. It is tied by taking the rope round the object and making a Half Hitch round the standing part. This is worked tight and close up to the object before making the second Half Hitch and working it tight and close up. If the Half Hitches are left loose the knot can spill easily. In critical situations, it is best to secure the end with a seizing.


337. Two Half Hitches

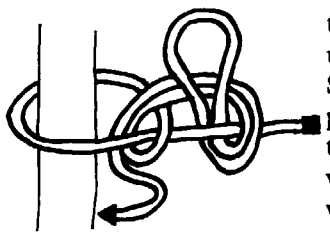
One of the knots used to bind twine round parcels is the **Packet Knot (338)**. It consists of Two Half Hitches tied round the standing part (338B),



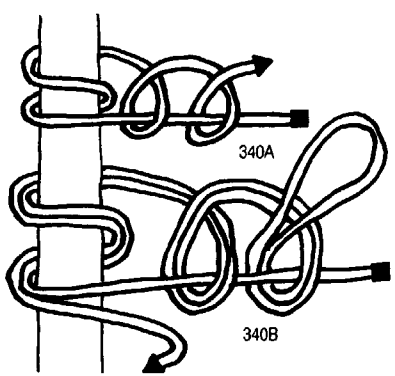
338. Packet Knot

sometimes made by tying a Granny Knot (161; 338A) and capsizing by pulling the standing part. Secure the knot by pulling tight and casting a Half Hitch in the standing part over the running end (338C).

The Half Hitches, specially the first, in Two Half Hitches (337) can jam tight if subjected to a heavy load, and become very difficult to untie. This can be remedied by making **Two Slipped Half Hitches (339)**. First make a Slippery Hitch (334B), work it tight and close up and then make a second Half Hitch in the bight and work tight. The hitch in the bight rarely jams and when it is removed, the first Half Hitch is readily slipped.


339. Two Slipped Half Hitches

The **Round Turn and Two Half Hitches (340)** fastens a rope to an object such as a spar or picket; it is less liable to jam than 337 and is particularly suitable for making fast to an anchorage a heavy load; the round turn allows the load to be held while completing the knot and keeps the tension on the first Half Hitch relatively low. Work the Half Hitches tight and close up as for 337. Seize the running end to the standing part for greatest security and least liability to jam. If the rope is much longer than is needed for the knot, there is no need to reeve the whole length of the rope through the knot; the whole knot, round turn and both Half Hitches, can be tied in the bight (340B); this bight knot, with the Half Hitches round both standing part and running end, has been used to attach a gut fishing line to a swivel. When rope and anchorage are slippery, a single round turn may not hold the load while tying the knot. More round turns may be made, but if that is difficult or impossible, the **Backhanded Hitch (341)** may be made. Take a bight round the anchorage, pass the running end through it, work tight and make two Half Hitches. This knot can also be used when it is more convenient to make one pass (of the bight) round the object, rather



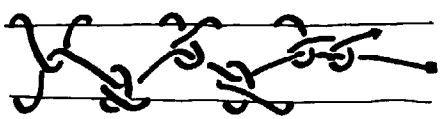
340. Round Turn and Two Half Hitches

341. Backhanded Hitch

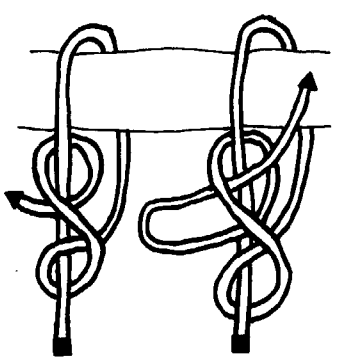
than the two (for the round turn). The back turn provides more friction than the round turn, but cannot be pulled as tight and is also a source of weakness.

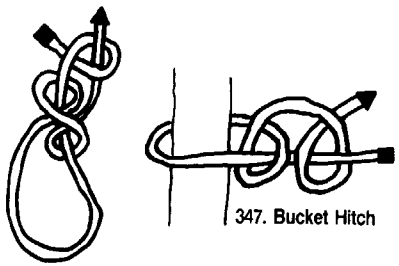
The **Racking Hitch (342)** is used to tighten a guy or the like when adequate tackle is unavailable. Make a turn, or possibly a round turn, around a wide anchorage and work as tight as possible. Make a Half Hitch with the running end round the standing part and pull away from the standing part, around the anchorage; make a Half Hitch and continue until sufficiently tight. Finish with two Half Hitches. If simple turns are applied instead of Half Hitches, it is more difficult to hold the load whilst completing the knot, but the knot would then be analogous to the Back Mooring Hitch (321), which requires a quick release. An almost identical hitch for a pull along the spar is the **Jumper Hitch (343)**. This has been used with circus tents where the roof is suspended from a vertical pole with no cleats. Make a turn, or a round turn, around the pole, pass the running end behind the pole, make a Half Hitch with the end, pull back round again and so on. Finish with two Half Hitches. A helping hand is needed to pull down on the rope while making the Half Hitches.

342. Racking Hitch


343. Jumper Hitch

The **Buntline Hitch (344)** is used to make fast a rope to an object when the pull is at right angles. Compared with Two Half Hitches (337) it is more secure, more compact and withstands better a give and take motion or flogging in the wind when unladen, but it jams much harder. This may be an advantage at times; Two Half Hitches (337) needs to have the running end seized to the standing part in some situations, but if a Buntline Hitch is used, no seizing should be necessary. The knot can also be used as a light binding knot or noose that will draw up tight but be hard to slip. One way of tying a tie or cravat is with a Buntline Hitch. It is made with two Half Hitches but tied away from the standing part instead of towards it. Trouble with jamming is minimised by making a **Slip Buntline Hitch (345)**, said to be the most secure slippery hitch. Slipping the knot can still be difficult if the pull is parallel with the spar, not perpendicular to it.


344. Buntline Hitch 345. Slip Buntline Hitch



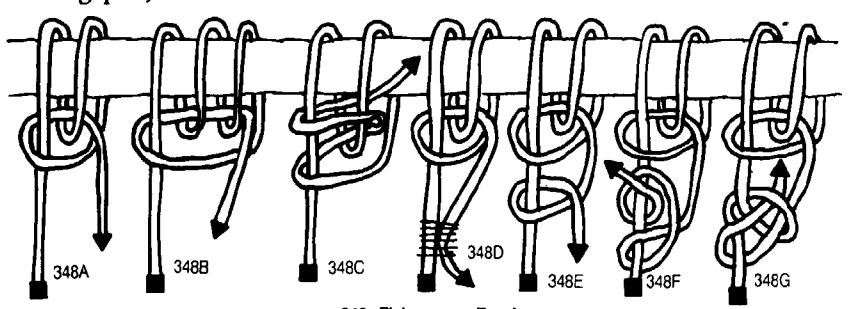
346. Corned Beef Knot

The **Corned Beef Knot (346)** is the most secure of the packers' ties; it used to be used to bind corned beef during curing, taking up the slack as the meat shrank. It consists of a Buntline Hitch finally secured by casting a Half Hitch with the standing part on the running end.

So far, in all knots with two Half Hitches both hitches have the same handedness. The **Bucket Hitch (347)** has them of opposite handedness. It cannot be drawn up as tight as Two Half Hitches (337), it is less secure and is possibly a little weaker, but it is easier to untie. It is easy to make by mistake for Two Half Hitches in a number of applications but should be avoided in critical situations.

HALF HITCHES INTO ROUND TURN

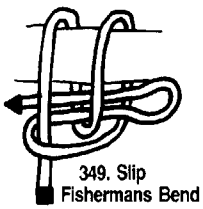
A round turn is made on an object and then, instead of a half hitch around the standing part, the first half hitch is made to include the round turn.



348. Fishermans Bend

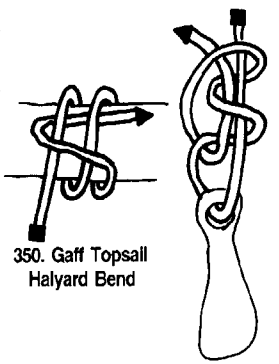
The **Fishermans Bend (348)** is a secure method of fastening a rope to a spar or the like. It is the best for fastening a rope to an anchor where a reliable knot is wanted that will work well out of sight, withstanding a give and take motion and with minimal chafing at the knot. It does not jam as badly as a Round Turn and Two Half Hitches (340). The basic knot is shown in 348A: a round turn and a half hitch passing through the round turn; if the object being fastened is small in diameter compared to the rope, an extra turn or two (348B) will give less chafe. These knots hold reasonably well when tied in a rough natural rope, but even then it is usual, and with synthetics essential, to ask for more security. The simplest but least effective way to achieve this is to add an extra turn to the Half Hitch (348C); this compact knot has been used to attach a gut fishing line to a swivel. The traditional ways are to apply a seizing (348D) or add a Half Hitch round the standing part (348E), perhaps

also seized, but the use of a Buntline Hitch (344; 348F) is more secure with slippery synthetics and a Bowline is said to be most secure (348G) with natural ropes (care must be taken that the load is shared evenly between the two legs). A quick release version is the **Slip Fishermans Bend (349)**, which can be secured if necessary with a Half Hitch, as in 348E, tied in the bight as in 339.



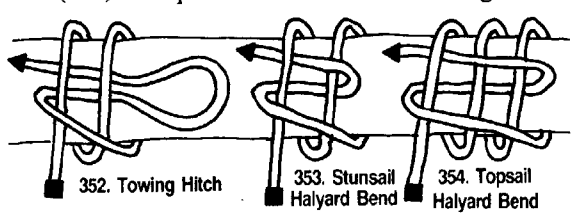
349. Slip Fishermans Bend

The Halyard Bends (Gaff Topsail, Stunsail and Topsail) are good snug hitches of increasing security, increasing elaboration and increasing difficulty of untying after heavy loading, left over from the days of sail. For most purposes the only advantage of using all three is that you can distinguish the knots, and hence where the rope went, by feel alone. The **Gaff Topsail Halyard Bend (350)** has a turn, subject to two nips against the spar or whatever, instead of the Half Hitch, subject to one, in the Fishermans Bend (348); note that this is a Double Overhand Knot (62F) with the spar in the intestinal space. A noose made by tying a Gaff Topsail Halyard Bend around the standing part has been used as a **Sash Weight Knot (351)**, a secure knot, necessary because it is out of sight and out of reach, for fastening a sash cord to its weight. The **Towing Hitch (352)** is a quick release knot for making fast a tow rope that may need to be freed in an emergency, though note that on a rough or rectangular object considerable force may be needed to unreeve the round turn. It is a Slip Gaff Topsail Halyard Bend. The **Stunsail Halyard Bend (353)** which has a tucked end would be more secure than 350, and the **Topsail Halyard Bend (354)** with an extra turn more secure again—possibly more than is warranted.



350. Gaff Topsail Halyard Bend

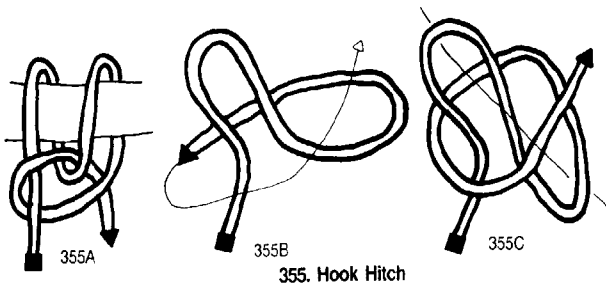
351. Sash Weight Knot



352. Towing Hitch

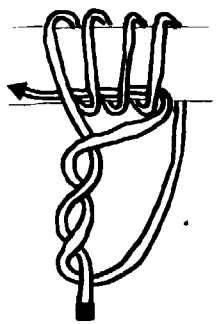
353. Stunsail Halyard Bend

354. Topsail Halyard Bend



355. Hook Hitch

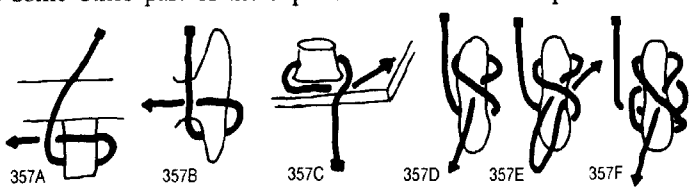
The **Hook Hitch (355)** is a secure knot to fasten the running end of a rope to a hook or spar etc. It is like the Fishermans Bend (348) except that the half hitch is of opposite handedness. To pass it over the end of a hook or spar it is easiest to place a bight over the running end (355B), passing the end across the knot (355C) and placing the two indicated bights over the hook and working tight. Note that this does not need access to the running end, unlike the Fishermans or Halyard Bends.


356. Arbor Knot

The **Arbor Knot (356)** is one of the most secure knots for fastening a fishing line to a reel. Several round turns are taken on the reel, the running end twisted a couple of times with the standing part, passed under all the turns and worked tight.

ISOLATED SINGLE HITCHES

In this Section, Single Hitches are made either direct round some object or around some other part of the rope than in knots in the previous Sections.

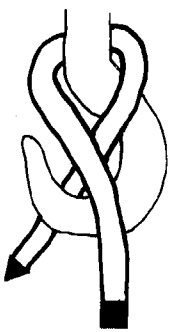


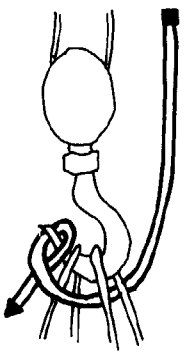
357. Belaying Hitch

The **Belaying Hitch (357)** is a means of fastening a halyard or the like to a cleat, belaying pin or similar object. In its basic form it consists of a Single Hitch (357A, B, C); care needs to be taken that the running end is securely trapped under the standing part and that the load is steady in both force and direction. It is more usual to take one or more turns before the Single Hitch to reduce the strain on the hitch. These turns are usually in figure eight form (357D), but sometimes the first turn is round the base of the cleat (357F). The hitch may be slipped (357E). If the rope is long, take a small number of figure eight turns and apply a Single Hitch, then a few loose hanging turns round the

cleat and finish with another Single Hitch. If the rope is very long, consider a Halyard Coil (27).

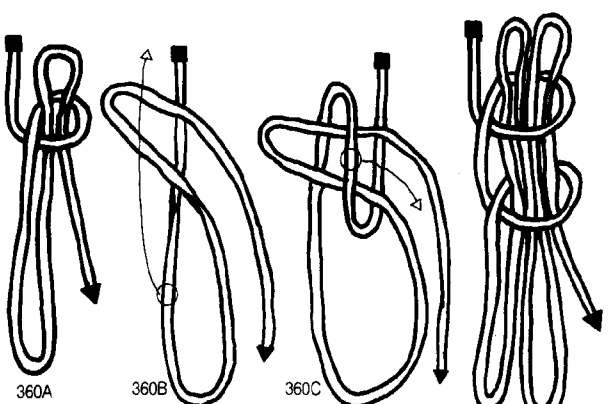
The **Single Blackwall Hitch (358)** attaches a rope or chain to a hook that holds while the load is steady but releases freely when the load is removed. The knot will work with chain on most hooks, but for rope the hook must be properly engineered, not just a bent pointed rod and the rope must be of the appropriate size; be careful of slippery synthetic ropes. The knot consists of a Single Hitch worked into the mouth of the hook, with the standing part high on the back of the hook. The same knot can be used to lift a sack or bag (not too full) on a hook, or even to carry a sack in the hand with the fingers crooked, which is a bit easier, or at least a change, compared with gripping the bag.


358. Single Blackwall Hitch


359. Bosuns Hitch

The **Bosuns Hitch (359)** is a Single Hitch used to make fast temporarily the fall of a tackle on a bosuns chair or the like. The fall should pass through the ropes holding the chair so that the hook will not be twisted.

The **Bellringers Knot (360)** is a quick release knot to keep the end of a vertical rope off the floor when not in use. Make a Single Hitch in the standing part and pass a bight of the running end through it and work tight (360A); alternatively, hold a bight of the running end over the standing part (360B), flick a turn of the lower standing part around the bight and pull the upper standing part to form the Single Hitch (360C). If you need to make several coils of the rope to keep it up, specially if it is slippery, use a **Double Bellringers Knot (361)**, with two Single Hitches kept apart.

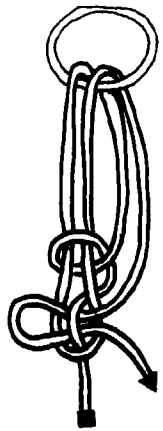


360. Bellringers Knot

361. Double Bellringers Knot

The **Truckies Hitch (362)** is used as a rope tackle to tighten a rope thrown over a load on a truck or the like.

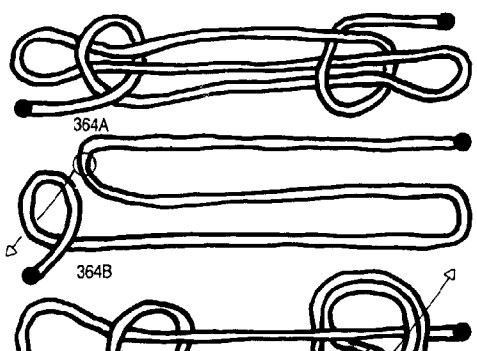
362. Truckies Hitch



363. Sheepshank Hitch

Pass the running end under the hitching rail, then make a Bellringers Knot (360) above it; hold the knot while bringing up the running end and passing it through the bight (362). For greater security, two Single Hitches may be used, in a similar way to 361. Truckies often make fast to the rail with a Clove Hitch (372), but this can shake loose; it is better to use Two Half Hitches (337). If there are difficulties in making the running end fast to the rail, make two half hitches round both returns immediately below the lower bight of the Bellringers Knot.

The **Sheepshank Hitch (363)** is a quick release knot for fastening a rope to an anchorage that is in reach only of a cast rope, such as making fast a boat subject to a rise and fall of tide. Cast a bight over the anchorage and pass it through a Single Hitch in the standing part. Bring a small bight of the standing part through the first bight and pass a bight of the running end between the two previous bights.



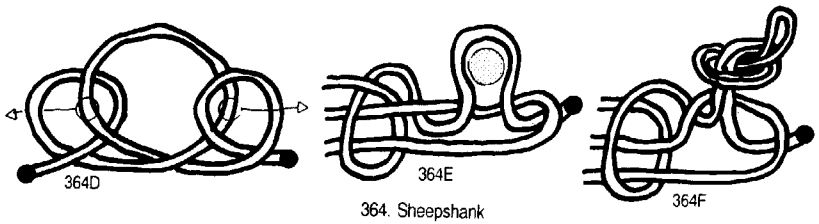
364A

364B

364C

364. Sheepshank

Three uses are generally given for a **Sheepshank (364)**: to shorten a long rope; to bridge a weak section; or to tighten a rope whose ends are fixed. Other methods are often preferable for the first two purposes: for a long rope, work with the bight (as in, for example, 339, 340) and coil the surplus out of the way; for a weak section, remember that a Sheepshank will weaken the rope so that it may be better to cut out the weak section and rejoin the ends with an appropriate bend or splice. Stronger and more secure alternatives for both these purposes for longer lengths include the Chain Sennit (75) or the Single-Strand Threefold Plait (286), for shorter lengths the Alpine Butterfly Loop (123); even the Overhand Loop (134) is more secure. Only for tightening a lot of slack is the Sheepshank often the method of choice. Make a large S-bend (with any weak section in the middle) (364B). Cast a half hitch with each running end over the adjacent bight; this may be done as indicated in 364B, but to tighten a rope it is best to make the S-bend fairly tight, make a half hitch with the bight over the running end (364C), then transfer it (30) to the end. Alternatively, make three underhand

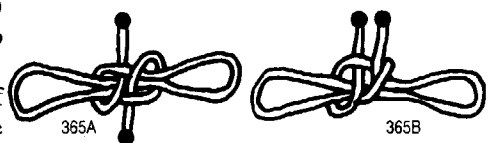


364D 364E 364F

364. Sheepshank

loops and overlap them as shown (364D); the centre loop gives the size of the finished knot, and any weak section should be at its top. Pass the sides of the central loop through the adjacent half hitches as indicated. A Sheepshank will not withstand much shaking unless you insert a toggle (364E) or make an Overhand Loop (134) in the running end through the bight (364F), in each case working the half hitch tight up to the toggle or knot; or make one of the Sheepshank variants (92, 432).

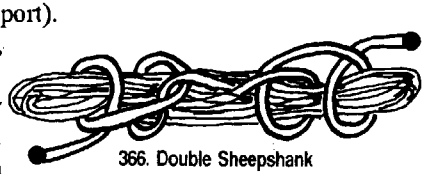
The **Sheepshank Loop (365)** can be made by working the two half hitches of the Sheepshank close into the middle and tight. If the two half hitches are of the same handedness you have a decorative lanyard knot (365A), sometimes used in kite tails, but if you have them of opposite handedness you have a pair of splayed loops (365B) that could be used to sling a ladder horizontally etc (maybe the ends could be joined in a Bowline or the like for support).



365A 365B

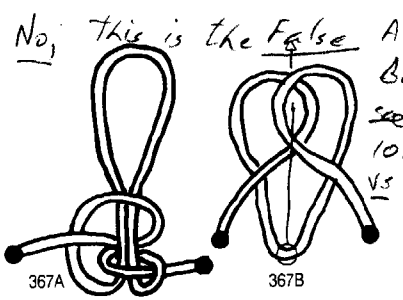
365. Sheepshank Loop

If there is a lot of slack to take up, it is better to make a **Double Sheepshank (366)** than a long ordinary Sheepshank. Make several hanks and throw two half hitches with each running end.



366. Double Sheepshank

The **Linesmans Loop (367)** is the easiest loop in the bight to make and the easiest to get the loop the right length but it is not the most secure. It is least secure when there is no pull on the loop, only between the two ends. It is made by taking a bight of the right size and casting a half hitch over it with each end in turn. Or use a similar method to that used for the Fishermans Loop (104E; 367B), working tight with the two ends pulling against each other.



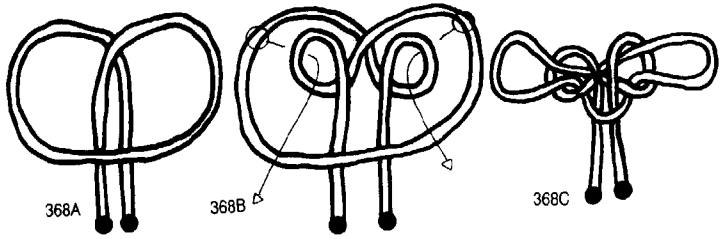
No, this is the False Alpine Butterfly. See 104E vs 123.

367A 367B

367. Linesmans Loop

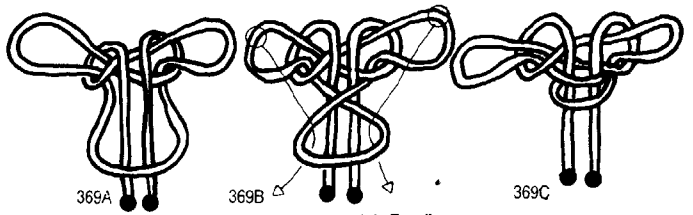
The **Spanish Bowline (368)** consists of two splayed loops in the bight of a rope, used for slinging such loads as a ladder; as a chair knot, the splay of

the loops makes it a little more comfortable to sit in with one loop for each thigh. The methods described by others for tying the knot in the hand are difficult to remember and confusing to tie if the loops are of any size; the method I describe, while it must be used on a table or floor, is better.



368. Spanish Bowline

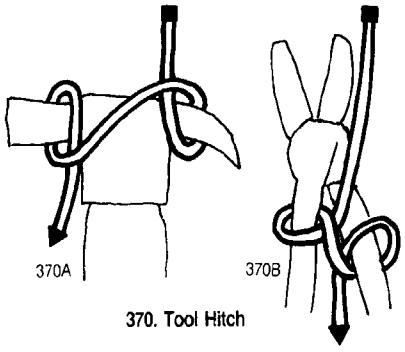
Make a bight, put a twist in it and place the bight over the standing parts (368A). Place turns of opposite handedness in the standing parts as shown (368B) and pass bights through the turns as indicated (368B) and draw tight (368C). Like many double loops in the bight, the loops of the Spanish Bowline connect in a way that allows ready transfer from one to the other.



369. Locked Spanish Bowline

This can be prevented by making a **Locked Spanish Bowline (369)** where both loops are fixed. Make a Spanish Bowline and draw out the central bight, the lead that connects the two loops (369A). Put a twist in this (369B) and pass the whole knot through this so that the bight appears at the back (369C).

SINGLE HITCHES IN SERIES



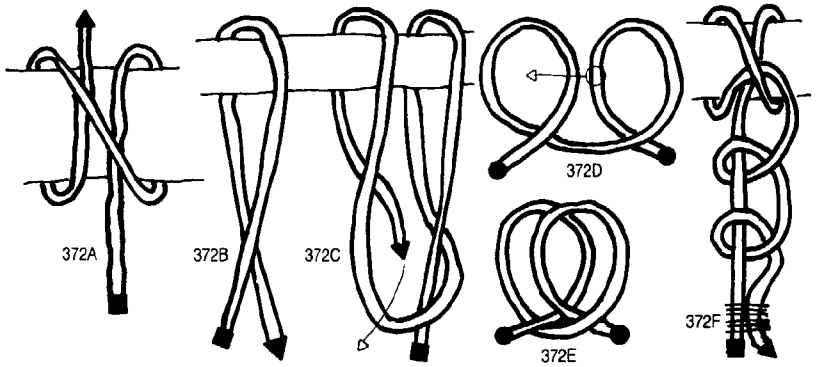
370. Tool Hitch

In this Section, there are two or more Single Hitches working against each other, in many cases being in contact.

The **Tool Hitch (370)** is a readily applied hitch for raising, as to a scaffold, tools that have appropriate projections such as hammers (370A) or pliers with the legs open (370B). It consists of two single hitches of the same handedness around two projections above the centre of gravity.

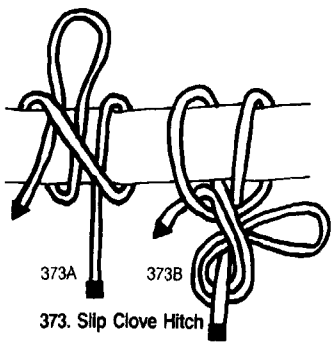
The **Anglers Hitch (371)** is a simple attachment to an eyed hook. The first single hitch should be worked tight up to the eye so that the line coming out of it exerts maximum pressure on the running end; the second single hitch holds things in place, though sometimes a third hitch may be needed.

371. Anglers Hitch



372. Clove Hitch

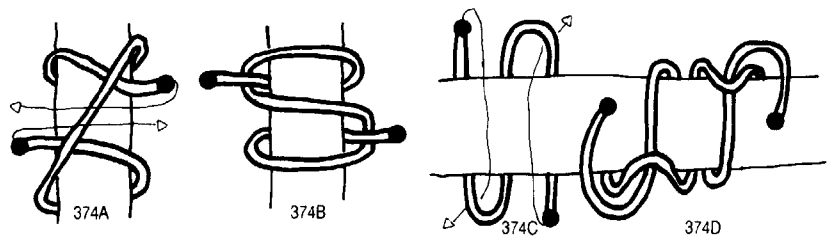
The **Clove Hitch (372)** attaches a rope to a spar or other object. When tied tightly it will withstand a considerable sideways pull, though it is not the best for a completely lengthways pull; it is particularly suitable to secure guys to a vertical spar, both for support and during erection. It may also be used as a binding knot, particularly for rough rope round a rough object. It works well with the pull on both ends, such as for a crossing knot as in ratlines, or for attaching a pair of droppers above an Overhand Knot in the main fishing line or as a secure crossing knot for parcels and the like. To tie it, pass the running end over the spar or other object and bring it back to the standing part to cross it (372B); it is often an advantage, specially if you are working at some distance from the spar, to grasp this crossover until the next step is completed. Pass the running end over the spar again, in the same direction and on the opposite side of the first turn to the crossover (372C), then bring the running end through between the two turns. Alternatively, if the end of the spar is within reach, make two Underhand Turns in the rope (372D), overlap them (372E) and pass the two turns over the spar. Tighten by pulling the two ends against each other (372A). The Clove Hitch is insecure unless there is a load on both ends. In other applications, the running end should be secured to the standing part with one or two half hitches and/or a seizing. For greatest security, make the Clove Hitch and tighten it; make a Half Hitch and tighten it with pulls in both directions over the centre of the Clove Hitch and as close to it as possible; make a second Half Hitch and work it in the same way tight on to the first, and apply a seizing (372F).



373. Slip Clove Hitch

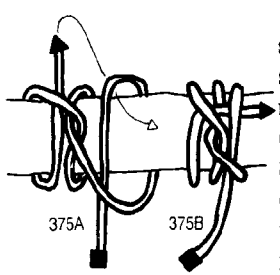
The **Slip Clove Hitch (373A)** is a quick release fastening to a spar for moderate loads; it is usually necessary to make one or two Half Hitches with the bight on the standing part (373B).

The **Oklahoma Hitch (374)** is a useful crossing knot with more bearing surface than a Clove Hitch, binding knot for a bundle of poles, or attachment for a vertical rope to a horizontal plank, including an arm sling. It may be tied by making a very loose Clove Hitch (374A) and pulling back both ends (374B), or by placing an



374. Oklahoma Hitch

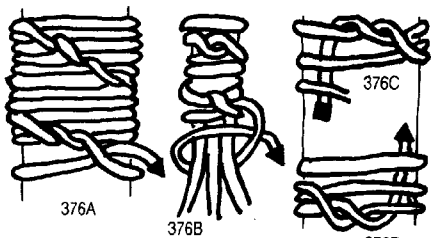
S-bend under the object (374C) and bringing the ends back and through the loops of the S (374D). To tie up a bundle of poles, bring back the running end against the bights (i.e., behind 374B or above 374D) and join with a Reef Knot or the like. An arm sling, say to support a break or other injury, is used in the 374D form, giving three ropes below the limb. To sling a horizontal plank, make the hitch at each end. It is usually best to join the running ends to the standing parts well above the plank with Bowlines or the like and, if attaching a single rope to a hook, a Catspaw (50) in the bight.



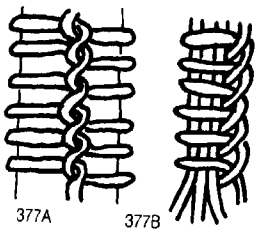
375. Jammed Clove Hitch

A **Jammed Clove Hitch (375)** is another way of securing both ends of the Clove Hitch. It is more secure for a pull along the spar and has been recommended for attaching a line to non-eyed hooks, especially emergency home-made ones. Make three Single Hitches away from the load (in the direction of the pull), with the first kept loose (375A); work the last two tight, pass the running end under the first (375B) and work tight.

A series of Half Hitches one after the other has several applications, mainly primarily decorative. There are two configurations, 376 and 377. **Spiral Half Hitching (376)** works the Half Hitches tight against each other. 376A shows a decorative covering for a rail, steering wheel or the like; 376B is a **Corkscrew Bar**, used in macramé work, with Half Hitches round a core of, usually, three other cords. A **French Whipping (376C,D)** is



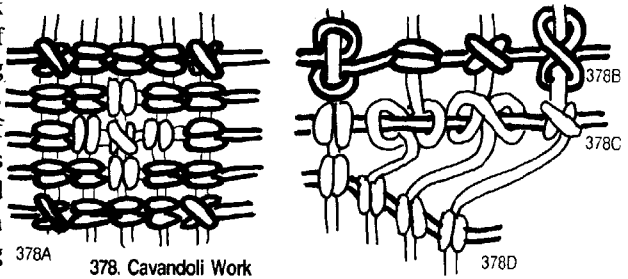
376. Spiral Half Hitching



377. Buttonhole Half Hitching

tied with whipping twine round a rope; start with a Half Knot (141), with the end tucked under the whipping (376C), then make the necessary number of Half Hitches, worked tight and close. The last two or three hitches should be kept loose and the end tucked back under them (376D) before pulling all tight with pliers or forceps. In **Buttonhole Half Hitching (377)** the hitches are not made so tight, but worked back so that they align parallel with the core. The **Single-Strand Simple Coxcomb (377A)** is a simple covering for rails etc, while the **Buttonhole Bar (377B)** round a core of, usually, three cords, is used in macramé work.

Cavandoli Work (378) is a kind of decorative weaving using Clove Hitches at each crossing of warp and weft; it is usually considered part of macramé. In **Vertical Cording (378B)** the vertical

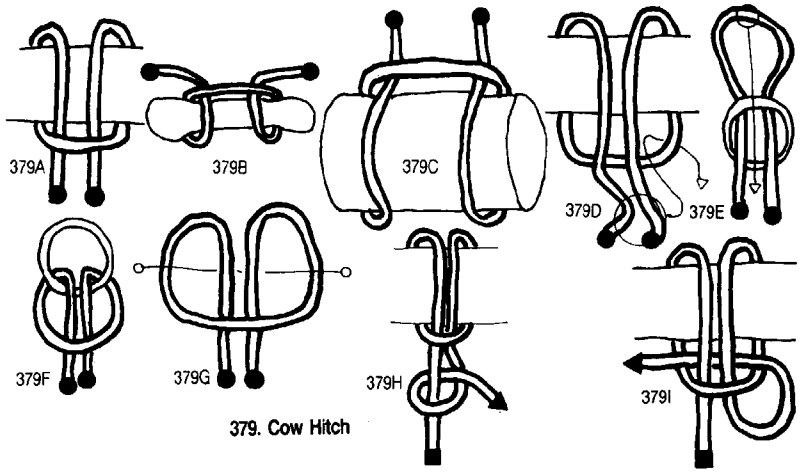


378. Cavandoli Work

warp remains straight and the Clove Hitches are made with the horizontal weft; it is usual to display the back of the Clove Hitch, as on the left, but sometimes having the front showing, as on the right, adds variety. In **Horizontal Cording (378C)** the Clove Hitches are made with the vertical warp; again the usual configuration, to the left, displays the back of the hitches. **Diagonal Cording (378D)** has the weft taking a diagonal or curved line, and the warp is clove hitched to it where wanted; note how the warp cords come together. Interesting patterns can be formed by arrangements of Horizontal, Vertical and Diagonal Cording, and Clove Hitch backs or fronts showing, and by having the warp and weft of different colour or texture. Some of these effects are illustrated in 378A.

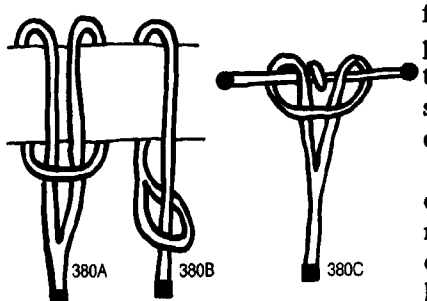
CHANGE OF HANDEDNESS OF SINGLE HITCHES

So far, all the Single Hitches have been of the same handedness, but a number of useful and decorative knots use alternating handedness in the hitches.



379. Cow Hitch

The **Cow Hitch (379)** attaches a rope to a spar in a way similar to a Clove Hitch but the two Single Hitches have opposite handedness. It is often easier to tie, but because of the change in direction it cannot be pulled up as tight as a Clove Hitch, and is less likely to jam, but is unsatisfactory for a single longways pull. It can be used as a crossing knot; or to attach an object in mid-line, such as a solid sinker without an eye to a fishing line (379B). To lift a load (379C), the two ends can be joined to make a handle, or thrown over the shoulders and held in the hands to carry on the back (note the relation to the Bale Sling Hitch, 328A). Easy ways to tie include passing a bight round the object and bringing the ends through the bight (379D); or passing a bight into a ring (379E) and bringing the bight back over the ring and the standing part (379F); or making a bight, casting it over the standing part and picking up the standing parts between the two turns (379G). The Cow Hitch is even less secure than the Clove Hitch unless there is a load on both ends, specially where rope and spar are slippery. The running end can be secured to the standing part with one (379H) or two Half Hitches, or the end can be tucked between the bight and the standing parts (379I). But the Cow Hitch is more frequently applied with a loop, either permanent as a sling (including, e.g., the rubber band on luggage tags) or snotter, or temporary using a Bowline or other loop knot.

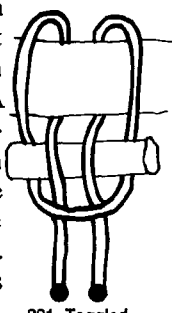


380. Running Eye

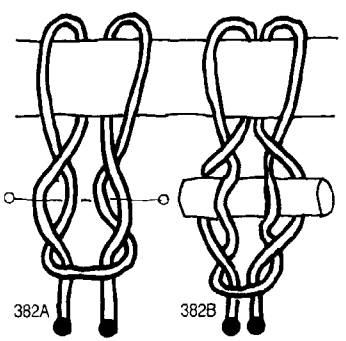
The **Running Eye (380)** fastens an eyed rope to a spar, ring or the like; its relation to the Cow Hitch (379) is obvious. For most purposes it is better to have a long eye (380A) so that the whole of the standing part can be

passed through in a bundle (as in 379D) or the bight passed over a ring (as in 379E). If the eye is small (380B), the standing part must be reeved through, which may be time-consuming. A similar knot is used on fishing line to attach a dropper (380C); in most instances you need either an Overhand Knot (58) tied in the leader, or a Float Stop (62H) over it, arranged in the middle of the knot to prevent slipping.

A Cow Hitch slipped in the usual way, with the last tuck of the running end taken in a bight, is very insecure. A quick release knot is the **Toggled Cow Hitch (381)**, which must have even tension on the two ends, so should be made with a loop of some sort. Instead of passing the ends through the bight as in 379D, insert a toggle between the bight and the ends. A particular use is on a guy that will be used to erect a spar which will be secured by other means, so that the guy can be removed from the ground. Of course, the knot must be worked really tight and a rope must be attached to the toggle; the running end should be fastened to the standing part with a Bowline or the like. The **Twist-Toggled Cow Hitch (382)** gives greater security. Pass the bight round behind the spar and back over the standing parts, then twist the legs of the bight with their standing part in opposite directions (382A) before inserting the toggle (382B).

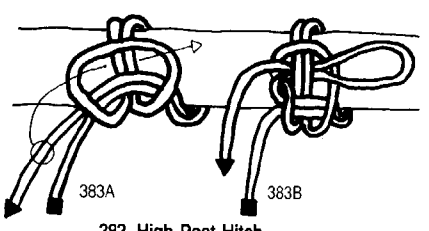


381. Toggled Cow Hitch

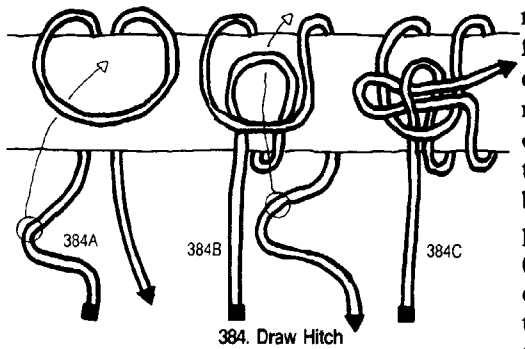


382. Twist-Toggled Cow Hitch

Instead of a toggle, a bight of the running end may be used to make a slip Cow Hitch, in at least two ways. The **High Post Hitch (383)** is a quick release knot for fastening a rope to a post or rail; it is specially useful if the running end is very long and you do not wish to pull all of it round the anchorage. It can also be useful as a towing hitch on to a rectangular plank where a quick release is wanted without having to unreeve a round turn, difficult on such an object. Pass a bight round the post and pull it back under and over the two ends (383A). Then pass a bight of the running end over this loop but under the standing parts (383B). There should be nothing on the post to catch the slip loop when withdrawing. The **Draw Hitch (384)** is a quick release knot for fastening a rope to a spar. It has been used to fasten an animal to a post and to lower an object from a height, allowing the whole rope to be recovered from the top. It is not recom-



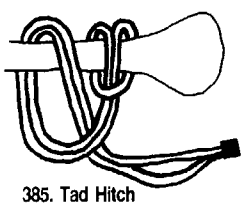
383. High Post Hitch

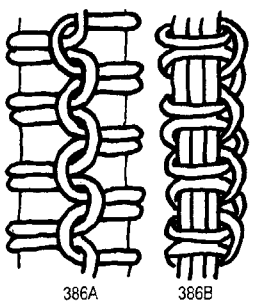


384. Draw Hitch

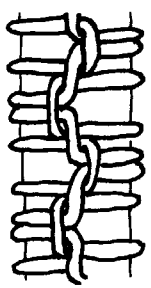
mended for climbing down from a height: it is safer to descend on a simple doubled rope passed round the anchorage. Pass a bight behind the spar (384A), pick up a bight of the standing part and pass it through the first bight (384B) and then pass a bight of the running end through the standing part bight (384C).

The **Tad Hitch (385)** fastens a fishing line to a non-eyed hook. Make a loop in the line and a Cow Hitch (379) round the hook and a Single Hitch with the bight below the hitch.


385. Tad Hitch



386. Tatting


387. Single-Strand Double Zigzag Coxcomb

A series of Single Hitches of alternating handedness is known as **Tatting (386)**. On a core of a rail, steering wheel or the like, it is known as a **Single-Strand Zigzag Coxcomb (386A)**; on a core of, usually, three cords, as a **Single Tatted Bar (386B)**, used in macramé work. If the series consists of two Single Hitches of one handedness followed by two of the other and so on, we have a **Single-Strand Double Zigzag Coxcomb (387)**.

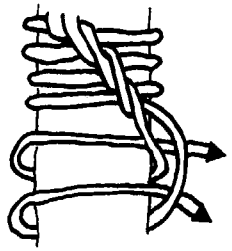
MULTISTRAND SINGLE HITCHES

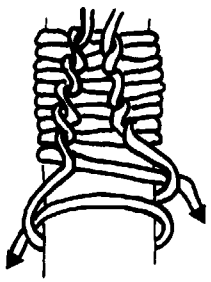
These knots are all decorative. A large number of variants is possible; only a few are shown here, but some are briefly described but not illustrated.

The **Chain Bar (388)** links two cords in macramé work with alternate Single Hitches of opposite handedness. When four cords are used, working the hitches in pairs, it is known as a **Double Chain Bar**. Similar half hitching round a core is a **Genoese Bar (389)**. The **Double Genoese Bar** uses Clove Hitches and the **Double Tatted Bar** uses Cow Hitches instead of the Single

388. Chain Bar

389. Genoese Bar

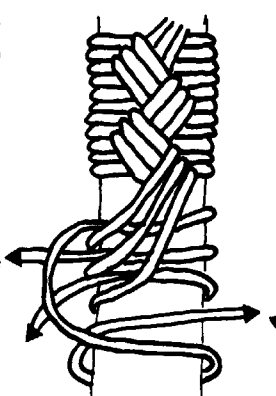

390. Multistrand Spiral Half-Hitching

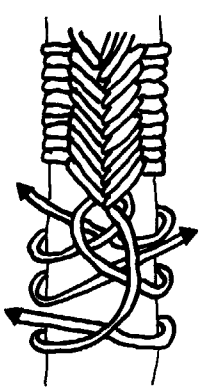

391. Dual-Strand Simple Coxcomb

Hitches of the Genoese Bar. In all cases, the initial hitches on the two sides should be of opposite handedness. A **Waved Bar** uses a series of perhaps five or six single hitches on each side instead of the two in the Double Genoese Bar.

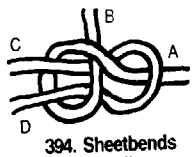
Multistrand Spiral Half-Hitching uses from two **(390)** up to about six strands, each making a Single Hitch of the same handedness in turn. This produces a large raised apparent coil spiralling round the core, though it is possible to force this coil parallel to the axis of the core, making a **Multistrand Simple Coxcomb**, analogous to 377. The **Dual-Strand Simple Coxcomb (391)** the two strands make Single Hitches each of different handedness but, usually, close together.

The **Multistrand Zigzag Coxcomb (392)** contains from two to about six strands. A Single Hitch of one handedness is made by each strand in turn, followed by another Single Hitch of the opposite handedness by each, and so on. The **Multistrand Herringbone Coxcomb (393)** has an odd number of strands, most likely three or five. Taking the rearmost strand in turn, make a left-handed Single Hitch, then a right-handed Single Hitch, then a left-handed one and so on.


392. Multistrand Zigzag Coxcomb


393. Multistrand Herringbone Coxcomb

Chapter 17
SHEETBENDS AND BOWLINES



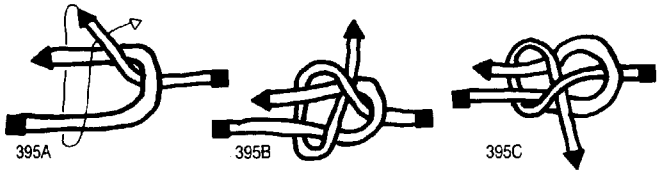
394. Sheetbends and Bowlines

The **sheetbend/bowline formation** is the most important asymmetrical knotting formation used in bends and loops. It consists of a turn or Single Hitch (388; AB) united with a loop or bight (388; CD); a big variety of knots can be formed, depending on which ends, A, B, C, D are running ends and which standing parts and so on: see 521. The most important are the Sheetbend in which A and either C or D are the standing parts of two separate ropes, and the Bowline in which A is the standing part and the loop is formed from either BC or BD. These have been called "perfect" knots though the "perfection" is in fact something of a myth, specially when using synthetic ropes, as will be discussed later. A considerable number of methods of tying them has been developed, only some of which are described here.

SIMPLE SHEETBENDS AND BOWLINES

In this Section, the primary classification is based on the method of tying the knots; in fact, with these knots, this does keep structurally closely related knots together.

Making the Loop first



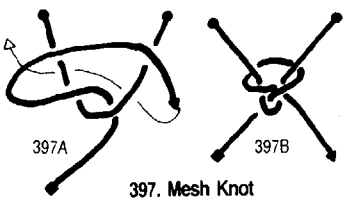
395. Sheetbend

The **Sheetbend (395)** is a good general-purpose bend; it can be used with ropes of moderately unequal thickness, but the thicker rope should form the loop, not the turn. Make a flat loop with one rope and bring the running end of the other rope up into the loop (395A), round the loop and under its own standing part (395B). It is generally recommended that the two running ends should be on the same side of the knot (395B), rather than opposite (395C), which is believed to be less secure, and is called a **Left-Handed Sheetbend**.

396. Becket Hitch

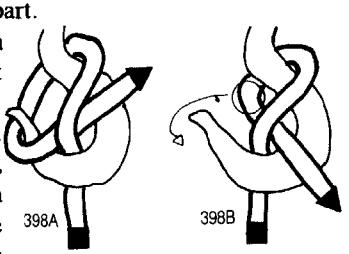
The **Becket Hitch (396)** is used for attaching a rope to a loop; it is made precisely as for a Sheetbend (395). If used in fishing line to attach a fly line to a leader loop, it is advisable to stop the end with an Overhand Knot in the end of the fly line (396B), when it is known as a **Jam Knot**; the same knot used to be used to tie gut fishing lines to an eyed hook (396C).

The **Mesh Knot (397)** is the commonest knot used in ordinary diagonal netting. Pass the cord into the mesh from below, then over and round it, leaving a large bight (397A). Take the cord under the mesh and through the bight (397B); take care that the cord remains above the mesh bight while tightening, and does not transfer below it on to its standing part.



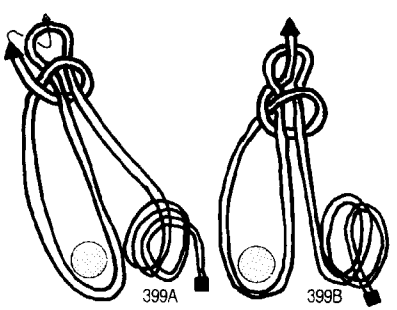
397. Mesh Knot

The **Bill Hitch (398)** attaches a rope to a properly engineered hook of appropriate size; it holds well under a steady tension but releases quickly on removal of the load. It may be tied in the same way as the Becket Hitch (396), using the hook as the loop, or by making a Blackwall Hitch (358; 398B) and lifting the trapped bight over the nose of the hook, as shown.



398. Bill Hitch

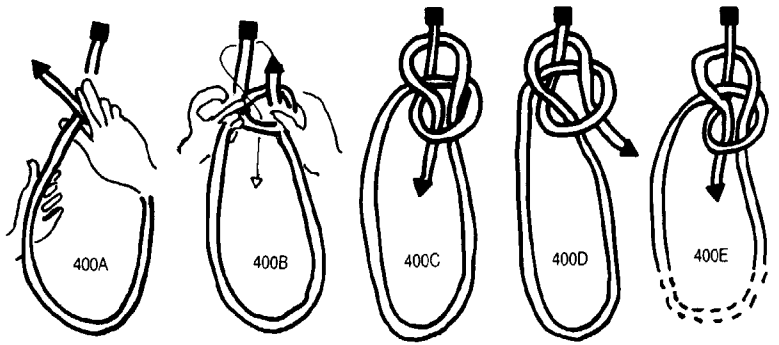
The **Ring Bowline (399)** has a special use: if you have a very long rope but wish to have a short length available for some purpose, but attached to, for example, a ring. Pull out the required amount of rope from the bulk and, leaving the required amount of running end, make an S-bend, enclosing the anchorage in the running end bight; cast a half hitch with the running end round the standing bight (399A). Pass the running end through the standing bight (399B), work tight and use the running end as desired.



399. Ring Bowline

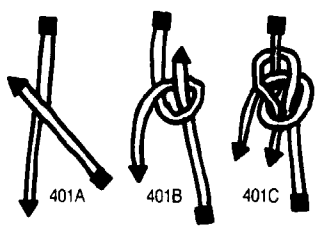
Making the Turn first

The **Bowline (400)** is a satisfactory, though over-rated, loop in natural-fibre rope, less satisfactory in synthetics.



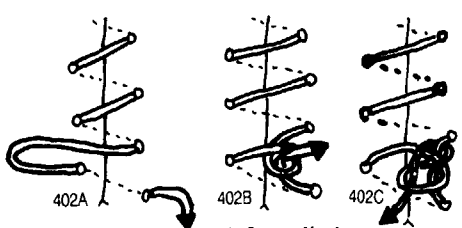
400. Bowline

Hold the standing part in the left hand, palm up just below where the neck is wanted and hold the running end in the right hand, palm down, across the standing part with the thumb below it (400A). Turn the right hand palm up, forming a turn in the standing part with the running end through the turn (400B); as you form the turn, grasp the crossover in the left hand. Then pass the running end away from you, round behind the standing part and back down the turn, parallel with its start (400C) and work tight. When the running end is inside the loop (400C), the knot is known as a **Sailors Bowline**. This is held to be a little more secure than the **Cowboys Bowline** where the running end passes round the standing part in the opposite direction and finishes outside the loop (400D). Note that a bowline is often used to unite the running end with the standing part of a number of knots, such as a Fishermans Bend (348, a Scaffold Hitch (470) or a Bowline on a Bight (437); in 400E, the dotted line represents the other knot.



401. Facing Sheetbend

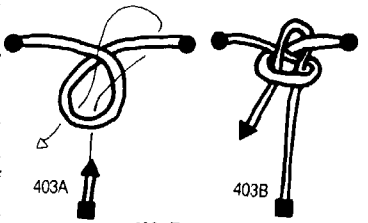
If you are joining two ropes that run from in front of you to behind you, instead of from side to side, make a **Facing Sheetbend (401)** in precisely the same way as in 400, except that instead of the bight in 400A you have the running end of the forward rope and the standing part of the rearward (401A). Carry on with 401B,C, as in 400B,C.



402. Suture Knot

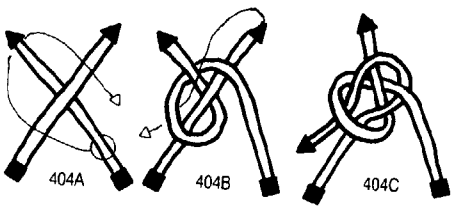
The **Suture Knot (402)** is one way of finishing a continuous suture in surgery. Keep the last stitch loose (402A) and make a right-handed turn in the bight (402B), passing the running end through the turn. Then pass the running end behind the standing part and back down the turn (402C) and work tight.

The **T-Bend (403)** secures the end of one rope to the bight of another perpendicular to it; it has been used to lift a second rope, or a rope holding tools etc, attached to a vertical rope kept in place on, e.g., a construction site for the purpose. Make a right-hand turn in the bight (403A) and pass the running end of the other rope up through the turn, round the right-hand standing part and back through the turn (403B). The knot is only really secure when there is load on all three ends, specially if they are of different thickness or slippery and flexible.



403. T-Bend

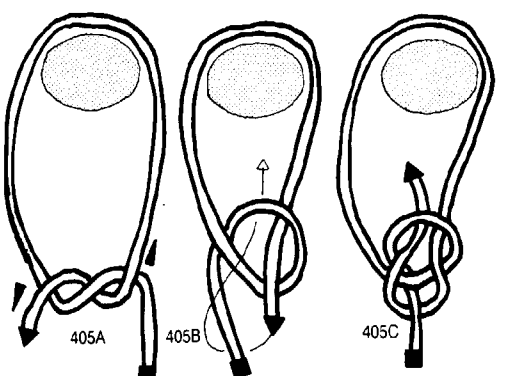
The Weavers Knot (404) is a quick way of joining two pieces of thread or twine, indeed any light line. Cross the two ends (404A) with the right-hand line below the left-hand one and the crossover held between thumb and forefinger of the left hand. Pass a bight of the right-hand line behind the crossover over its own running end (404B), forming a Crossing Knot (318), and then pass the running end of the left-hand cord into the turn (404C).



404. Weavers Knot

Starting with a Half Knot

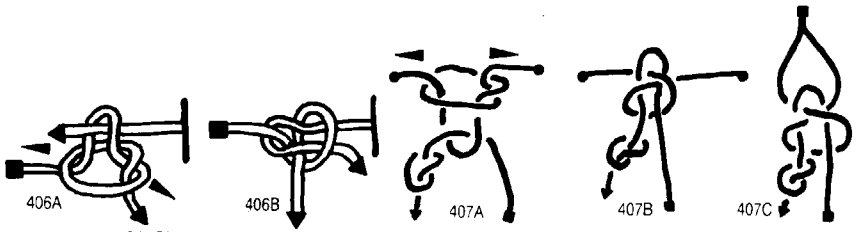
The **Cast Bowline (405)** places a loop round an object in front of you. Pass the rope around the object and make a loose Half Knot (405A). Capsize the Half Knot so that the running end is straight and a turn appears in the standing part (405B). Pass the running end around the standing part and back through the turn (405C). The analogous way of making a sheetbend, starting with 1½ turns between two parallel running ends, seems to have no real application.



405. Cast Bowline

Starting with an Overhand Noose

The **Short End Bend (406)** joins one rope to another which has only a short end projecting from something; it is only likely to hold if the ropes are

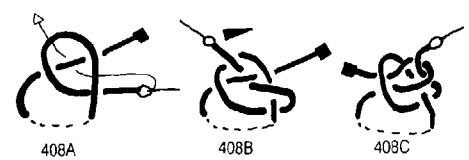


406. Short End Bend

407. Dropper Bend

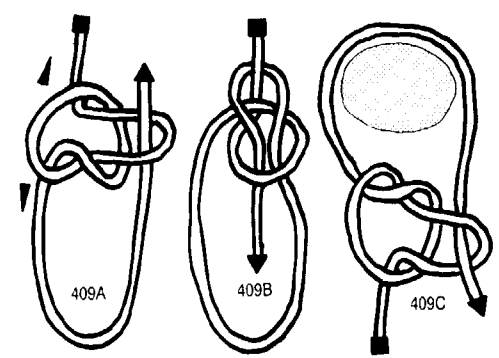
of rough natural fibres. Make an Overhand Noose (77) in the long end, insert the short end (406A) and carefully tighten and capsize the noose and capture the short end (406B).

Exactly the same process is used to make a **Dropper Bend (407)** to attach a snelled fly dropper to a leader line. Make a small Overhand Knot in the end of the dropper and pass it through an Overhand Noose tied in the bight of the leader (407A). Tighten and capsize the noose (407B). This is, of course, the same formation as the T-Bend (403). The **Fly Knot (407C)** is the identical knot used to attach a snell to a leader loop, instead of to a bight of a leader line.



408. Bookbinders Knot

The **Bookbinders Knot (408)** is used in sewing sections when binding books by hand. Stitch through the section and back, working from left to right. Cast a left-hand turn in the end with the needle and place it over the other (408A). Pass the needle through the turn, picking up the standing part (408B) and pull tight on the needle (408C) capsizing the standing part, and trim the ends.



409. Climbers Bowline

The **Climbers Bowline (409)** is a method formerly used by some climbers of tying a Bowline either round themselves or around some other object. Remember that this knot is not secure when made in kernmantle rope. Pass the end round the waist or into the waist harness karabiner, make an Overhand Noose and pass the running end into it (409A). Pull on the standing part, capsizing the noose and forming the Bowline (409B). To cast the Bowline round some other object, make sure it is the Overhand Noose, not a Slip Overhand that you tie (409C).

You can use the Climbers Bowline to tie the rope tight round an object. Make either 409A or 409C, work the noose small, tighten on the running end and then capsize.

SECURING SHEETBENDS AND BOWLINES

The Bowline has been called the "king of knots", and indeed it is very elegant, but it is notable that even before the days of slippery synthetic ropes there were many ways described to make a Bowline or Sheetbend "more secure". Nowadays, a simple Bowline or Sheetbend is always to be regarded as insecure for synthetic ropes, specially the stiff kernmantle. It is not unusual to combine two methods of adding security; I have, for example, seen climbers use a Double Bowline (415) with its running end secured with a Double Overhand Knot (62F). Kernmantle rope is stiffer than most yachting ropes, and those using it, climbers, cavers and rescue workers, are increasingly rejecting the Bowline; they never did use a Sheetbend much.

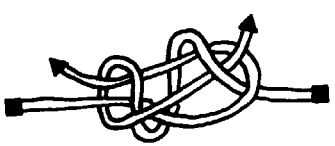
Possibly the simplest way of preventing the running ends from slipping through a knot is to tie a stopper knot in them. This is often done with fishing line, as with 396B and 407, but with rope it is more usual to fasten the running end to its standing part. This may be done with a seizing, or one or two Half Hitches, or a single or double Overhand Knot, or by tucking the end through the lay of the adjacent rope. An example is the **Secured Sheetbend (410)**; the Overhand Knots should have their running ends parallel with their main standing parts.

410. Secured Sheetbend

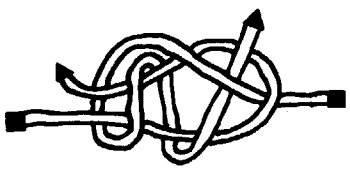
Of course, a Bowline has only one running end to secure; a long-established knot, the **Water Bowline (411)** uses an extra half hitch in the gooseneck. It was devised to prevent the Bowline from jamming so tightly in natural-fibre rope when the knot was immersed in water. Make it by repeating stage 400B; it is usual to keep the two hitches separate, not to work them close together.

411. Water Bowline

Rather than increasing the number of hitches, a common way of adding "greater security" is to increase the number of turns round the gooseneck. The **Rivermans Bend (412)** is easy to make and does not jam easily. Make a loop with one rope, the thicker if they differ, as in 395A, make two (sometimes three) turns round it and bring the running end across the knot and under its standing part. The **Double Sheetbend (413)** is similar except that both turns are under the standing part. It is a bit more secure, and a bit more suitable for ropes of very unequal thickness (use more turns, up to five or six, to form a **Manyfold**

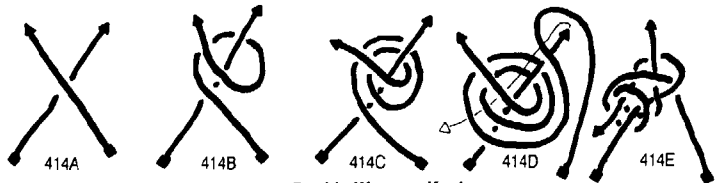


412. Rivermans Bend



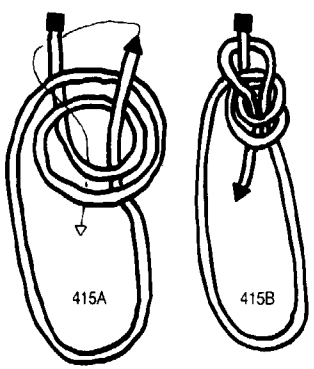
413. Double Sheetbend

Sheetbend). To tie it, make an ordinary Sheetbend (395) and take the running end round the loop and under its standing part once (or more times) again. A **Double Becket Hitch** would be made in the same way. A **Double Weavers Knot (414)** is made by crossing the yarns, this time right over left

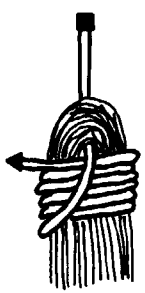


414. Double Weavers Knot

(414A). Loop the right-hand standing part under both running ends and over the left-hand standing part (414B) and repeat (414C), finishing with the standing part over the running end (414D). Pass the left-hand running end over the right-hand standing part (414E) and make tight.



415. Double Bowline



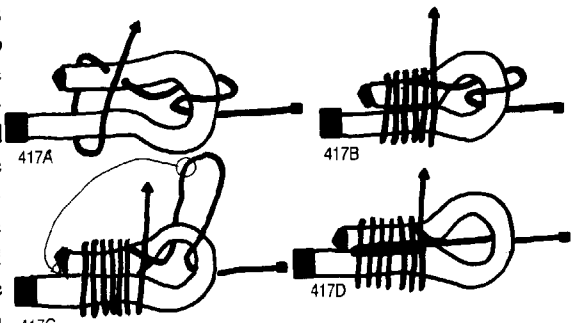
416. Multiple Sheetbend

To make a **Double Bowline (415)**, a double right-hand turn is made (415A) and the running end passed through the turns, behind the standing part and back through the turns (415B), as in the ordinary Bowline (400). Occasionally, a triple Bowline is justified. Note that, if desired, these multiple Sheetbends and Bowlines can be made in various ways; bowlines using a Surgeons Half Knot (149) or higher instead of a Half Knot in 405, Sheetbends and Bowlines using a Poachers Noose (85) or higher instead of an Overhand Noose as in 406, 409.

The **Multiple Sheetbend (416)** joins a single line to many and is a simple four- to six-fold Sheetbend. If there is to be substantial pull on the strands, particularly if uneven, the bundle can be kept together by serving over the bundle in the region of the knot and seize an appropriate eye before tying it.

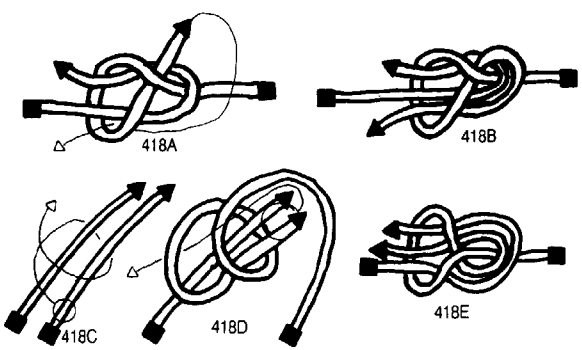
As already indicated, a four- to six-fold Sheetbend (413) can be used to bend a heaving line to a heavy hawser but if the difference in diameter is considerable or the hawser very stiff, it is not particularly secure. A better knot for the purpose is the **Seizing Bend (417)**. Form an eye in the hawser and make a round turn in the light line round its middle (417A). Pass the line running end to about one hawser diameter from its running end and take a

number of turns towards the eye (417B). Lift up the turn around the eye (417C) and pass it between the running end and standing part of the hawser, forming a frapping turn (417D). If there is to be much give and take motion, join the running end of the line to its standing part with a centred Bowline. The knot may be loosened by pulling on the running end of the line.



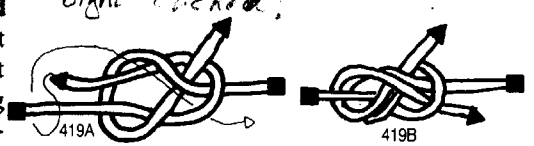
417. Seizing Bend

Another method of securing Sheetbends and Bowlines is to tuck a running end back into its knot. The **Turn-Tucked Sheetbend (418)** tucks the running end of the turn of the Sheetbend (418A) back into the turn (418B). It has both running ends pointing along the standing part of the loop; this is an advantage if the joined is to be pulled through obstructions. This knot has been used to tie a tapered fly-fishing line to a loop in the backing. It can also be based on a Double Sheetbend (413), passing the running end through both turns. Ropes of moderately unequal thickness can be used. A left-handed version of the Turn-tucked Sheetbend can be made by holding the two running ends together (418C) and taking a bight of the rope that is to make the turn around the two running ends (418D) which are then passed into the rearmost turn (418E) and worked tight.

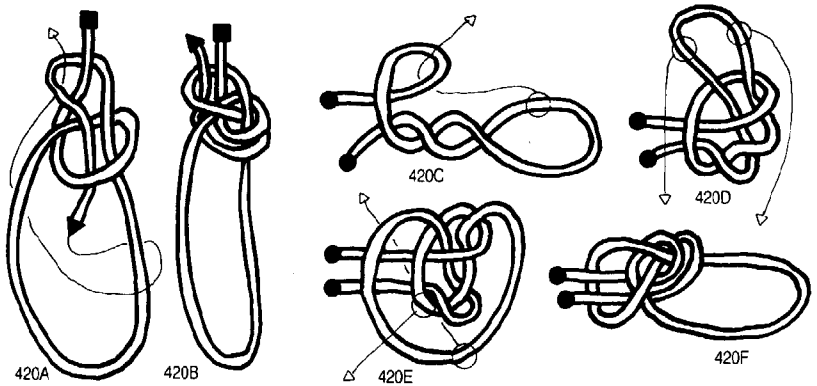


418. Turn-Tucked Sheetbend

The Loop-Tucked Sheetbend (419) works best when the ropes are of about equal thickness. The running end of the loop of the Sheetbend (419A) (or Double Sheetbend) follows the turn end from where it enters the turn back through the loop (419B). If both running ends are tucked, one as 418 and the other as 419, what you have is a Flemish Bend (313).



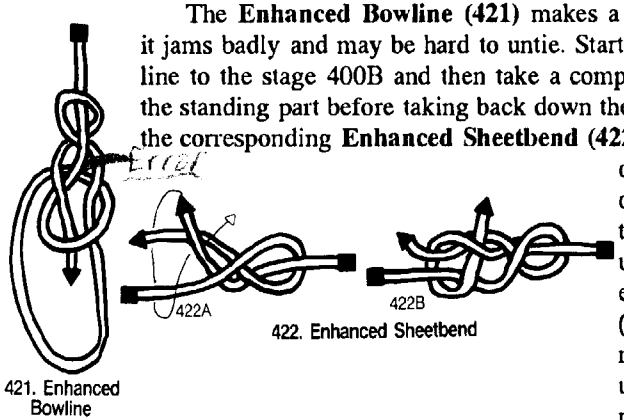
419. Loop-Tucked Sheetbend



420. Tucked Bowline ≈ Yosemite

The **Tucked Bowline (420)** has the same formation as 419. It will withstand a three-way pull between the two ends and is also secure for a pull between the loop and the running end. Make a Bowline (420A) (or Double Bowline, 415) and take the running end around its immediate standing part, through the Bowline loop behind the other leg and pass parallel to the standing part through its loop (420B). The Tucked Bowline can also be tied in the bight and is probably the most satisfactory of similar knots known as a **Single Bowline on a Bight**. Make 1½ twists at the base of a loop of the wanted size and a turn on one end of the of the bight (420C). Pass the upper leg of the loop up through the turn (420D); keep hold of the Overhand Knot so formed. Open up this bight and pass it over the knot (420E). Carefully pull down on the rope joining the two initial twists to make the loop, while the loop of 420E is passed behind the knot (420F). Take care that turns do not transfer.

The **Enhanced Bowline (421)** makes a very secure loop, but it jams badly and may be hard to untie. Start as an ordinary Bowline to the stage 400B and then take a complete round turn about the standing part before taking back down the initial turn. To make the corresponding **Enhanced Sheetbend (422)** make a turn instead of a loop and pass the other running end through this turn and up between the two ends of the first rope (422A), the passing it round the ropes and under its own standing part (422B).



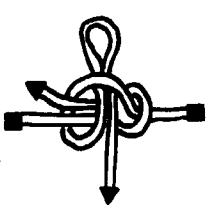
421. Enhanced Bowline

422. Enhanced Sheetbend

OTHER DERIVATIVES OF SHEETBENDS AND BOWLINES

This Section contains a variety of quick release knots and some other applications of the Sheetbend/Bowline formation.

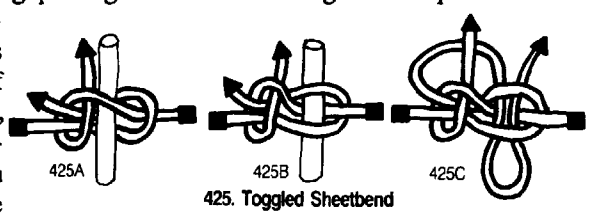
A Slip Sheetbend (423) has the turn slipped; a **Slip Becket Hitch** would work similarly. A loop-slipped Sheetbend is less secure. **A Slip Bowline (424)** of course has to slip the loop, but the tension in both ends of the turn make this sufficiently secure. A **Slip Double Bowline** works quite well, as does a **Loop-Slipped Double Sheetbend**. All these knots need to be worked tight carefully.



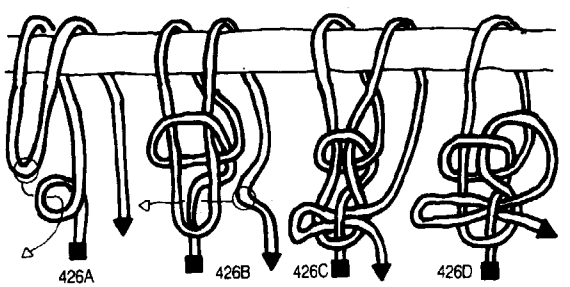
423. Slip Sheetbend

424. Slip Bowline

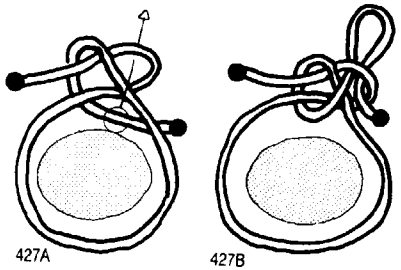
A Toggled Sheetbend (425) or Double Sheetbend is sometimes better than a slipped one. The toggle may be used simply to make untying easier by inserting it alongside the turn end (425A) of a completed Sheetbend, or it may make a **Slip-Toggled Sheetbend (425B)** by inserting it to hold a bight of the turn running end against the loop, avoiding passing the full end through the loop. Both these knots are more satisfactory as Becket Hitches (396) where both legs of the loop are loaded, specially if using slippery synthetic ropes; in all cases they must be carefully worked tight. Instead of a toggle, a bight of the loop running end may be used to make a **Release Sheetbend (425C)**; again, this must be carefully worked tight. The **Release Bowline (426)** is the counterpart of 425C. It can be used as a quick release way to make fast to an object out of reach. Cast a bight round the anchorage and make a right-hand turn in the standing part (426A). Pass the bight into the turn (426B) and then pass a bight of the running end between the loop and the standing part (426C). It must be worked tight with care. If the rope is too short, the running end need not pass over the anchorage but may be slipped directly (426D), but this is not quite as secure.



425. Toggled Sheetbend

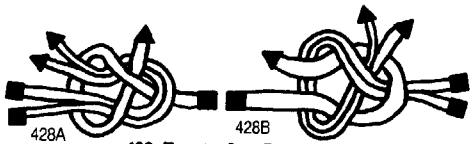


426. Release Bowline



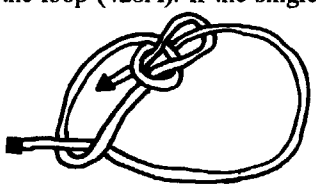
427. Girdle Knot

The **Girdle Knot (427)** is another variant of a Slip Sheetbend; it is a quick release binding knot for use on textiles such as dressing gowns or curtains. Take the cord round the object; make a bight in one end and pass the other end over and round that bight (427A). Take a bight of that running end and pass it over its own standing part and into the first bight (427B); pull tight on the running end of the first bight.

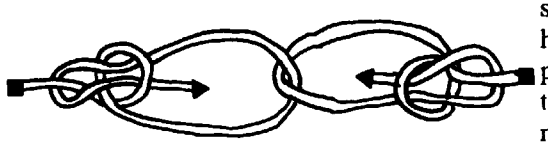


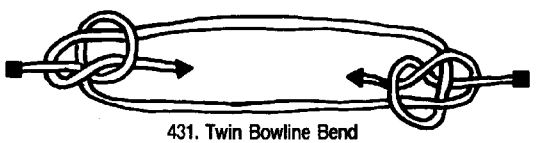
428. Two to One Bend

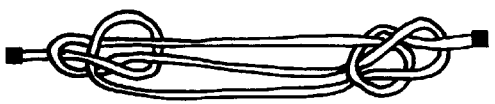
A Sheetbend can be used in the form of a **Two to One Bend (428)** to join two ropes to one. While the two ropes can be splayed quite a bit under load, they should not pull against each other. If all the ropes are about the same size, the pair of ropes should form the loop (428A). If the single rope is substantially thicker than the others then it should form the loop (428B).


429. Running Bowline

The **Running Bowline (429)** is probably the most popular loose noose, specially in natural-fibre rope. It may be tied by all the methods described in 35, most commonly by making a small Bowline round the standing part.

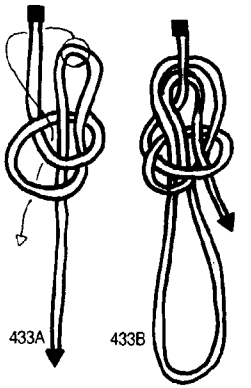

430. Bowline Bend


431. Twin Bowline Bend


432. Locked Sheepshank

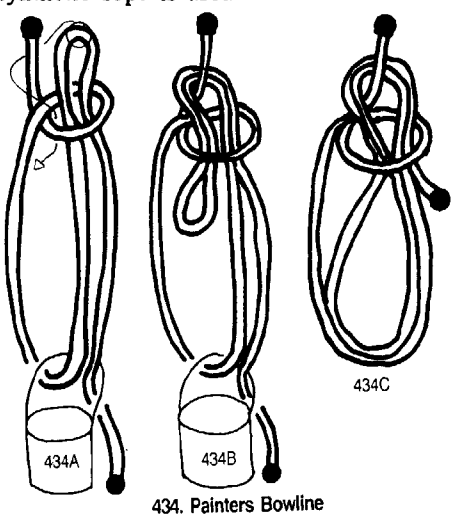
The **Bowline Bend (430)** is particularly suitable for bending heavy hawsers that do not need to pass round a capstan or through a hole etc, though it may be used for ropes of any thickness, including widely differing thicknesses. It is made simply by linking two Bowlines, appropriately secured. The **Twin Bowline Bend (431)** is a bit more trouble to make but is more satisfactory, particularly with synthetic hawsers, because there is none of the friction between the two loops. It is tied by making a Facing Sheetbend (401) appropriately secured with the running end of one rope on to the standing part of the other and then reversing ends. Care needs to be taken to get the two legs even.

The **Locked Sheepshank (432)** is the most secure form of Sheepshank (364) but needs access to at least one end. In form it is 431 with the two running ends joined. If both ends are available, make an ordinary Sheepshank (364C) and pass each end through the adjacent bight. If only one end is free, make a Bowline with that end with a very long running end; use it to cast a Half Hitch over the bight of the first Bowline and feed the end through the bight.



433. Bowline with a Bight

The **Bowline with a Bight (433)** has been used to attach a rope to a hook. Make a small Bowline using a long bight instead of the running end in 400B (433A). Work it tight with the bowline loop worked into the knot and the bight used for the hook; the running end needs securing with an Overhand Knot or the like, as in 410, particularly if synthetic rope is used.



434. Painters Bowline

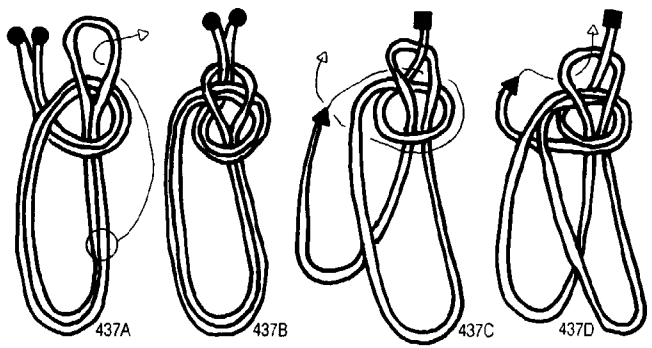
The **Painters Bowline (434)** makes a loop for suspending something (as a paint pot) in the bight of a long rope, such as one hanging beside the painter's scaffold. Pass a bight through the handle (434A) and use it to make a Bowline (434B). If the bight and the main loop are made the same size (434C), the knot is a bit more secure than 433 for attaching a rope to a hook, and puts less wear on the rope.

MULTIPLE LOOP BOWLINES

435. Triple Bowline

436. Locked Bowline

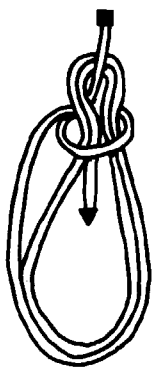
The **Triple Bowline (435)** gives three good loops in the bight of a rope. It makes a more comfortable chair knot than most; one of the main loops is placed under each thigh and the smaller loop is placed under the arms with the knot about level with the top of the head. It is simply made by tying a Bowline using the doubled rope. It is troublesome to adjust the lengths of the loops after tying. If the load is to be taken on one rope only, it is best to tie the other to it with a Bowline with the legs even, or alternatively make the Bowline first and then use the loop so formed for the Triple Bowline. The **Locked Bowline (436)** is the most secure of all two-loop bowlines in that it is virtually impossible for the loops to exchange lengths. It is made by passing the two main loops of the Triple Bowline through the smaller loop as indicated in 435. The knot needs to be worked tight.

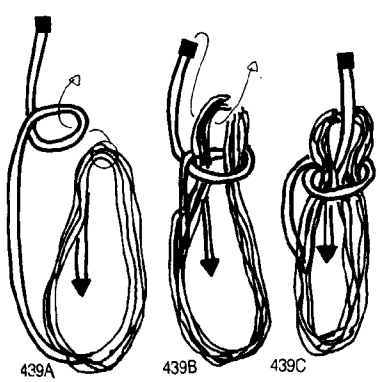


437. Bowline on a Bight

The Bowline on a Bight (437) makes two loops that are secure under load but can be fairly readily interchanged in length when unladen. It has been used to sling loads. It is mostly used as a chair knot, with either one loop under the thighs and the other under the arms, or (more comfortably and more safely provided the person is fully competent to hold on), one loop under each thigh. Some security may be given to the person by casting a Single Hitch with one rope under the arms and joining the two ropes with a Bowline fairly close to the hitch. The knot is usually tied using a bight of the rope, or if the load is to be held on one rope only, on an already made long Bowline loop. Start by making the first stage of a Bowline (400B) using the doubled rope (437A), then pass the double ropes through the bight, working them down and the bight up behind the standing parts (437B). However, to tie the knot into one or

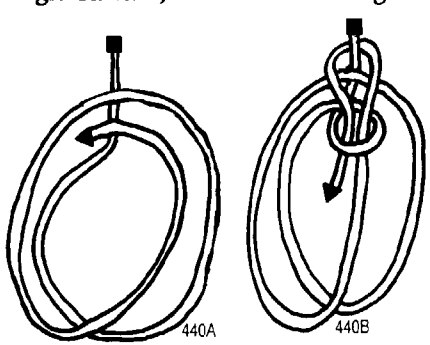
two fixed loops or rings, it can be tied with the running end. Make a Bowline into one ring using a long running end (437C); pass the running end back into the ring (or into the other) and follow the turn of the Bowline right round parallel to the standing part (437D). It is again desirable to join the running end to the standing part with a Bowline if the load is to be taken on one rope. Some climbers have used this method to tie into both a waist and a chest harness. It can also be used as a towing hitch to two anchorages.


438. Birmingham Bowline



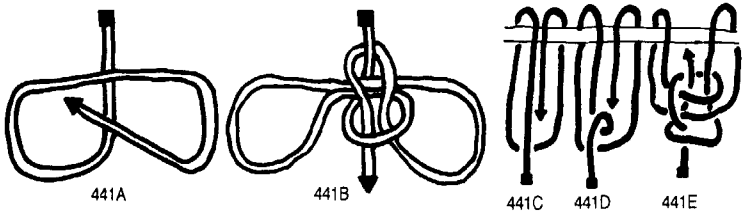
439. Bowline on a Skein

A Birmingham Bowline (438) forms two loops that are fairly easy to adjust when unladen. Make an ordinary Bowline and take the running end around the loop again, through the turn, round the standing part, and back through the turn, parallel with the first rope. More than two loops can be made, and the knot is then called a **Bowline on a Skein (439)**. If the standing end is readily available, it is often easiest to make the knot by forming the coil (439A) and casting over it a Single Hitch in the standing part (439B), then pass the standing part up through the middle of the coil (439C). The knot can readily be doubled by making a double turn, or two Single Hitches, instead of the Single Hitch.



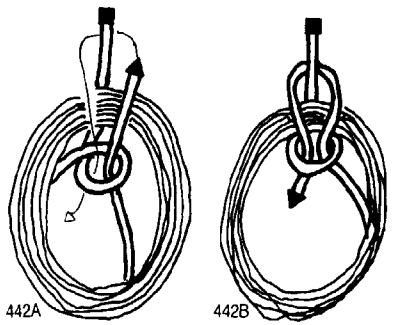
440. Portuguese Bowline

The **Portuguese Bowline (440)** makes two loops that are fairly readily interchanged in length even when under load. Make two anticlockwise coils with the second below the first (440A). Take this as corresponding to 400A and make a Bowline including the first coil between the standing part and the loop (440B). It is often advisable to secure the knot as in 410. The **Splayed Portuguese Bowline (441)** is a similar knot with splayed loops; it has been used for slinging a ladder horizontally, and a stretcher where there may be need to tip it sideways.



441. Splayed Portuguese Bowline

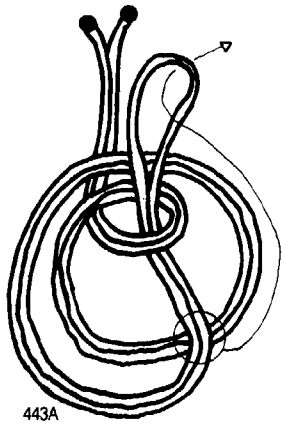
Make a clockwise coil over the standing part with some on each side and the running end over the standing part below the top of the coil (441A) and then complete the knot (441B) as for 440. It is also possible to cast a Splayed Portuguese Bowline over an object away from you; this has been used for towing from two points on a bar but only one pass behind it. Pass a bight over and round the anchorage and back under the ends (441C). Make a right-hand turn in the standing part and pass the running end down into this (441D), under the turn and bight, up over the standing part and back under and into the turn (441E). **The Bowline on a Coil (442)** is really a multiple Portuguese Bowline, where any number of coils are enclosed within a Bowline. It can be used to suspend a well-formed coil of rope on one of its ends. It used to be used by climbers to make a comfortable (perhaps four turns) waist length for the end persons and, tied entirely in the bight, the middle person on a climbing rope: it is now replaced by attaching the rope to separate harnesses. Form the coil and put a right-hand turn on the standing part inside the coil (442A), completing the knot in the usual way (442B).



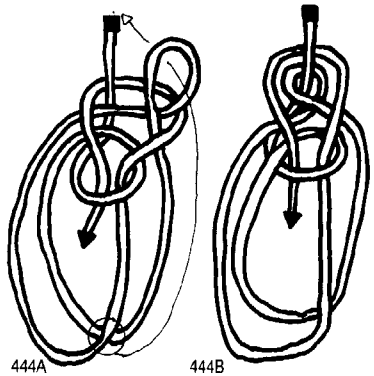
442. Bowline on a Coil

The **Portuguese Bowline on a Bight (443)** provides four loops in the bight of a rope. It is tied in a way analogous to the Bowline on a Bight (437): start as an ordinary Portuguese Bowline, using the doubled rope (443A), and pass the whole knot through the bight, which should be worked back up the standing part (443B). If the load is on one end only, it is advisable to tie the other end to it with a Bowline. A similar treatment would work with the Splayed Portuguese Bowline. Either form of Portuguese Bowline can be locked so that the loops cannot interchange, in the same way as the Locked Spanish Bowline (369). Pull out the upper coil inside the Bowline loop and put a twist in it (444A), and pass the whole knot through this turn as shown, working it behind the knot (444B) and work tight. The **Locked Portuguese Bowline (444)** may be made completely safe by securing the running end as in 410.

Sister Loops (445) is an interesting curiosity providing two loops to pull

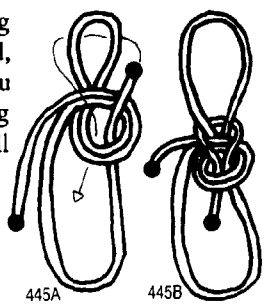


443. Portuguese Bowline on a Bight



444. Locked Portuguese Bowline

against each other, with no load on either end. Using a bight as standing part and the single running end, make a Bowline (445A) and work tight (445B); you may need to secure the running end to the standing part with an Overhand Knot as in 410 if the load will be considerable.



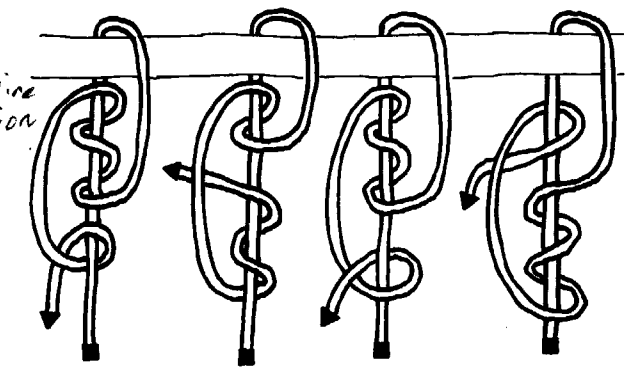
445. Sister Loops

Chapter 18
TUCKS AND TURNS

There is a wide variety of hitches in which one or more of the Half Hitches or Single Hitches are replaced by a round turn or a riding turn. In general these give a more secure longitudinal pull on the standing part but are relatively easy to move by handling the knot itself. Other knots have extra tucks or turns elsewhere.

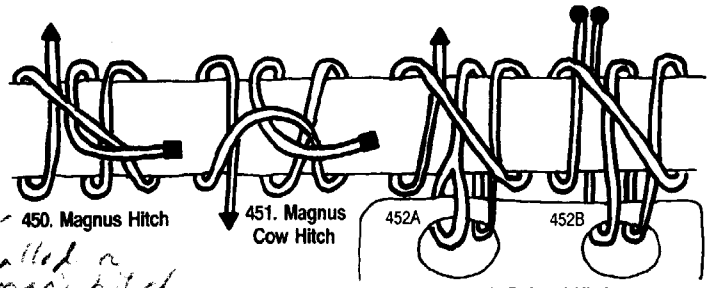
ROUND TURNS IN HITCHES

These are knots similar to those in Chapter 16 but at least one Half Hitch or Single Hitch is expanded to include a round turn.



446. Midshipmans Hitch 447. Midshipmans Back Hitch 448. Midshipmans Bucket Hitch 449. Jam Hitch

The **Midshipmans Hitch (446)** and the **Midshipmans Back Hitch (447)** are both more secure than Two Half Hitches when not worked tight on to the anchorage, while still being easy to move when unladen by handling the knot; I have not seen any comparison between these knots. The **Midshipmans Bucket Hitch (448)** where the Half Hitch and the round turns are of opposite handedness, is said to be less liable to twist when a long way from the anchorage. The **Jam Hitch (449)**, analogous to the Buntline Hitch (344) forms a noose which pulls tight easily but is hard to open up, so has been used as a binding knot round bundles or the like. It is also the basis of the Prince Albert method of tying a tie.



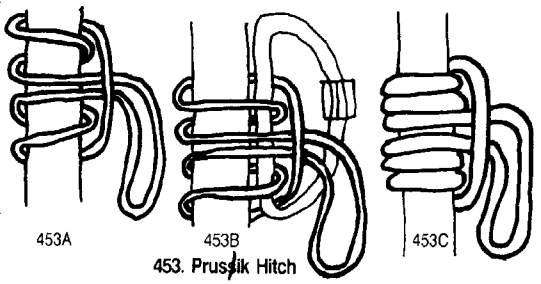
450. Magnus Hitch 451. Magnus Cow Hitch 452A 452B

452. Roband Hitch

The **Magnus Hitch (450)** fastens a rope to a spar or a larger rope where the pull tends to be along the spar. It is like a Clove Hitch (372) with an extra turn; as with the Clove Hitch it may need to have the running end secured to the standing part with two Half Hitches or the like. The knot can also be used as a crossing knot where the pull is a long way from perpendicular. The **Magnus Cow Hitch (451)** is said to apply less torsion to the object, but it cannot be pulled as tight. The **Roband Hitch (452)** was used to bend a sail to a yard but can be used to fasten any object with eyelets to a spar. If the knots are to be tied and untied frequently, it is worth attaching the rope to the eyelet with a splice (452A), make two turns round the spar including the eyelet and finish as a Magnus Hitch. Otherwise, pass the end behind the spar (452B) and join the ends round the spar with a Reef Knot or the like.

Greater security can be gained in these knots in most applications by using three or more turns in the main hitch instead of two, and two or more in the second instead of one. Only a few examples will be given, all of them symmetrical and some of special application.

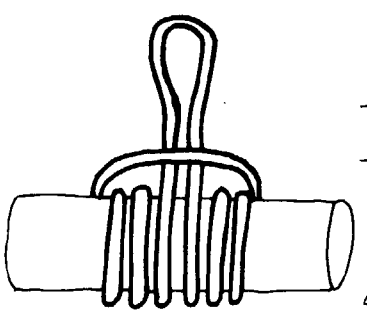
The **Prusik Hitch (453)** is used in climbing and caving to support the climber's weight on a sling attached to a vertical rope. It is also used with tackles where the attachment of the blocks to the main rope needs adjustment (see 552, 558, 559). The unladen sling can readily be moved up or down the rope by handling the knot, yet the full weight can be taken on the sling whenever needed. The sling should be of smaller diameter then the rope, perhaps half, and any join in the sling should not be incorporated in the knot. It is usually best if the sling and the rope be of similar composition and construction. If the rope is laid, the lower turns of the knot should be of the same handedness as the rope. It is possible to include a karabiner in the knot (453B) to facilitate moving the knot (the load must still be taken on the bight). Depending on the ropes used, it may be necessary to use three (453C) or even four turns instead of the original two (453A).



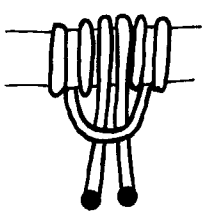
453A 453B 453C

453. Prussik Hitch

The **Double Bale Sling Hitch (454)** is applied to a horizontal more or less cylindrical load for attachment to a hook for lifting; the many turns tend to prevent the load slipping out of the sling; the knot has also been used as a bottle knot. It is virtually a Double Prussik Hitch. Likewise a **Tree Surgeons Knot (455)** is the same knot applied in the bight or end of a rope to a bough to grip it for manipulation.



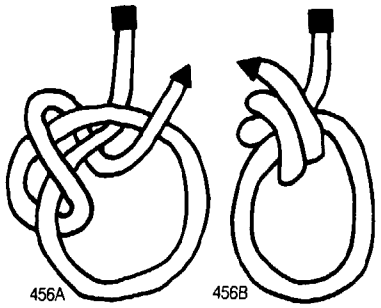
454. Double Bale Sling Hitch



455. Tree Surgeons Hitch

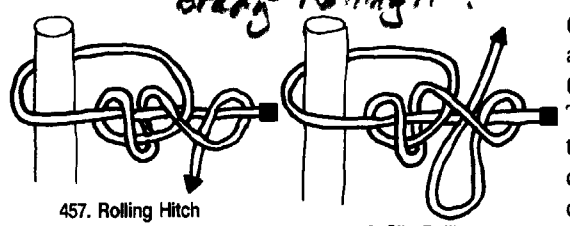
RIDING TURNS IN HITCHES

These knots are similar to those in the previous Section, except that the round turn is replaced by a riding turn.



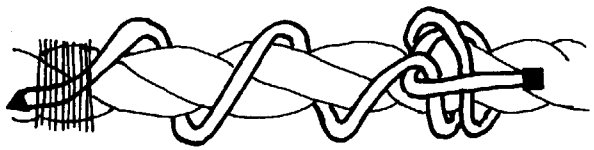
456. Shroud Knot

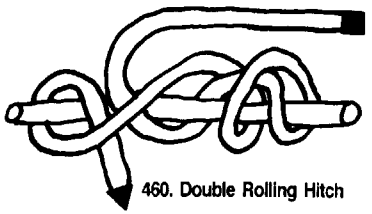
The **Shroud Knot (456)** is the riding turn basic to another series of knots, which gives a better grip than the round turns used before. While the Shroud Knot holds well under a steady load in stiff ropes, any jerk or relaxation will spill it completely. It has been used in temporary or emergency rigging with natural-fibre ropes, and has been suggested for self-rescue where making a fixed loop such as a bowline round yourself may be troublesome: it is a lot easier to hold the running end in place by hand than take all your weight by hand. To tie it, take the running end in a tight riding turn round the standing part towards the standing end (456A). Work it so that the running end is trapped between the first part of the riding turn and the standing part (456B). It is much safer to secure the running end in some additional way.

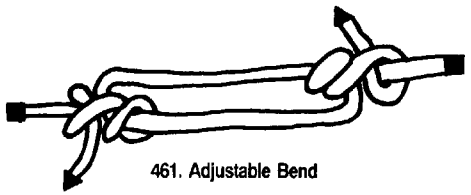

457. Rolling Hitch

458. Slip Rolling Hitch

The **Rolling Hitch (457)** uses a Half Hitch and the **Slip Rolling Hitch (458)** a Slippery Hitch. They make good fastenings to guys round pickets or other anchorages, which can be readily adjusted but still take a fair load. The Slip Rolling Hitch is an excellent quick release knot for such things as tent guys. The Rolling Hitch has been used to secure safety ropes to a main rope thrown over a roof, so that workers on the roof, secured to the safety ropes, can move up and down the roof along the rope. The **Stopper Hitch (459)** is used to relieve the load on another rope, which may be of the same or larger diameter; it can also be used on a chain or a spar. On laid rope, the riding turn is taken with the lay, and the running end then reversed and taken against the lay for several turns; finish with two Half Hitches or a seizing.

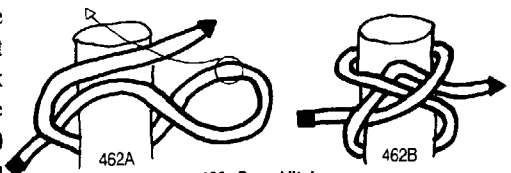

459. Stopper Hitch


460. Double Rolling Hitch


461. Adjustable Bend

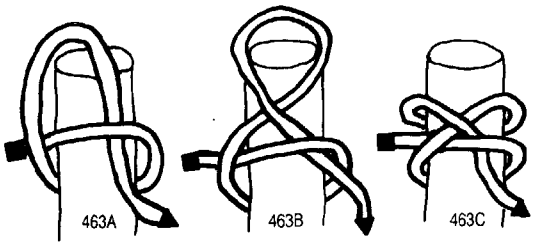
The **Double Rolling Hitch (460)** gives a firmer grip, and is suitable for synthetic ropes; it has two riding turns. The **Adjustable Bend (461)** joins two ropes so that they hold when under load but when unladen the overall length of the combined ropes can be changed by sliding the knots; under load, the knots hold. Each rope forms a Rolling Hitch or Double Rolling Hitch on the other.

EXTRA TUCKS AND TURNS



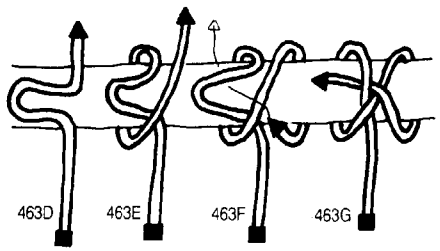
462. Spar Hitch

The **Spar Hitch (462)** can be used as a secure crossing knot on a spar or to fasten the neck of a sack or the like; it is more secure than a Clove Hitch (372) but not as hard to undo as a Constrictor Knot (150). It is often tied direct (462B), but can be tied in the bight: pass the running end loosely round the spar under the standing part, and put a twist in the bight (462A). Pass the twisted bight over the end of the spar, enclosing the running end (462B) and work tight.



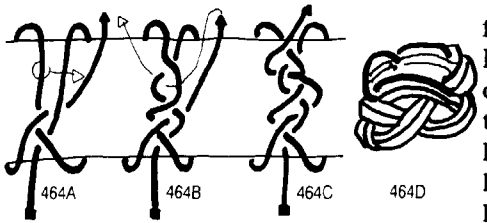
463. Millers Hitch

The Millers Hitch (463) has many uses, and it seems to have at least one name per use. As my preferred name implies, it is used to fasten sacks, but it is also used as a crossing knot on spars, to tie up animals to a rail (maybe in the Slip form), and, in cod fishing, to attach snelled hooks to the groundline. It is readily tied direct (463C) or in the bight: make a loose Half Knot round the object (463A), open up and put a twist in the standing loop of the spine (463B) and place that over the end of the object (463C).



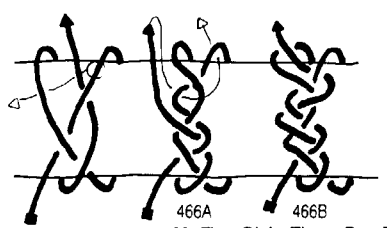
463. Millers Hitch

To attach to a groundline without wasting line, it is easiest to make a small bight which is held to the line (463D); take a turn over this bight (463E) and another on the other side of the standing part (463F); tuck the running end through the bight and pull tight on the standing part (463G).



464. Four-Bight Three-Part Turkshead

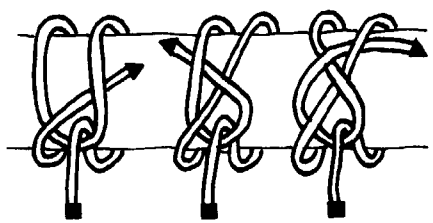
A Four-Bight Three-Part Turkshead (464) can be made from a Millers Hitch. Make a Millers Hitch (463C) round a core: it is often convenient to use two or three fingers of the left hand (464A). Place a bight of the left-hand strand over the right-hand strand without letting the twist run up to the start (464B). Pass the running end into the loop so formed and pass it back to the centre of the knot (464C) beside the standing part. This is a Single-Pass Four-Bight Three-Part Turkshead (see Chapter 20 below for terminology). It is usual to make a Double or Treble Turkshead by following the standing part with the running end, taking care to make each tuck correctly, right round another one or two times (464D). This Turkshead can be extended by passing the running end in 464C into the right-hand bight and repeating the actions of 464A, 464B and 464C; this will give a Single-Pass **Seven-Bight Three-Part Turkshead,** which can in turn be extended to 10, 13, . . . bights as desired.

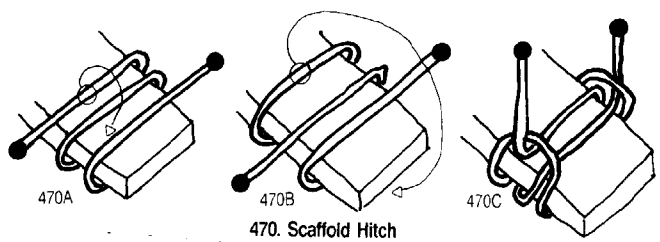

465. Bag Hitch

466. Five-Bight Three-Part Turkshead

A subtly different knot is the **Bag Hitch (465),** also used for fastening sacks. Note that it cannot be tied in the bight. As it stands, it is also a Single-Pass **Two-Bight Three-Part Turkshead** and can be doubled or trebled in the usual way. However, it is a rather sloppy turkshead that is usually best avoided. However, it is readily extended as 464, to a **Five-Bight Three-Part Turkshead (466)** (and thence to 8, 11, . . . bight Turksheads). From the Bag Hitch (465) pass a bight of the right-hand strand under the left-hand one (466A). Tuck the running end up into this bight and under the right-hand strand (466B) and then take it back to the standing part and follow through to double or treble as desired (466C).

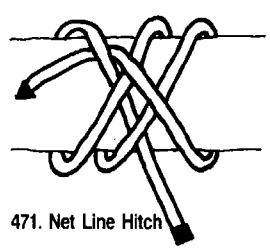
The **Ossel Hitch (467), Snug Hitch (468)** and **Two-Tuck Snug Hitch (469)** are progressively more complex and more secure knots for fastening a rope to a spar or another rope when the pull is at right angles. Ossel lines in deep-sea net-fishing run from the backing ropes with floats to the head ropes of the netting and the Ossel Hitch attaches the ossels to the head ropes; it is likely that the swelling of natural-fibre ropes in water helped keep this simple knot secure. All three knots start with the standing part behind the spar or whatever. All three could, if desired, be continued in the way of the Single-Strand Threefold Plait (282) to finish with a secure and decorative knot resembling the Sennit Snug Hitch (302).


467. Ossel Hitch 468. Snug Hitch 469. Two-Tuck Snug Hitch



470. Scaffold Hitch

The Scaffold Hitch (470) is used to sling a horizontal plank for working on constructions or repairs. Start with a full round turn round the plank, with three ropes on top (470A). Move the inner rope in between the other two (470B) and then pass the new inner rope over the end of the plank to the underneath (470C). Depending on how the plank is to be slung, it may be necessary to join the ends with a Bowline.


471. Net Line Hitch

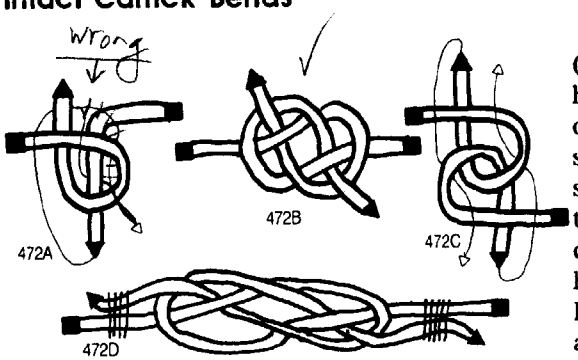
The Net Line Hitch (471) has several uses in deep-sea fishing. One is to fasten the ossels to the backing ropes (see 467); another is to fasten hooks to a cod groundline. It should be a secure knot for fastening a rope to a spar when the pull is roughly at right angles. To tie it, make two riding turns, as for the Double Rolling Hitch (460) but instead of finishing with a Half Hitch, tuck the running end under the standing part.

Chapter 19
CARRICK BENDS

These knots in basic form contain two interlinked turns. The name Carrick Bend has been given to three related but different knots. To emphasise their differences in structure and function, I call them the Carrick Bend (472), the Capsized Carrick Bend (477) and the Josephine Knot (482). I also consider a few related knots.

INTACT AND CAPSIZED CARRICK BENDS

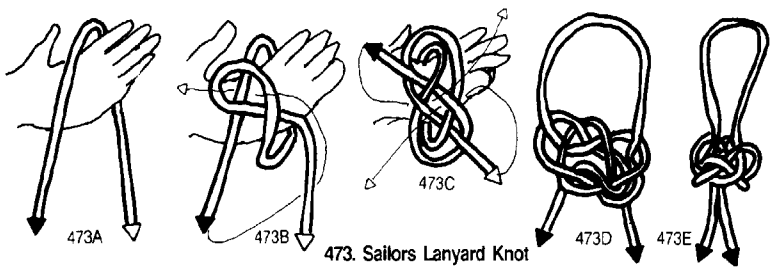
Intact Carrick Bends



472. Carrick Bend

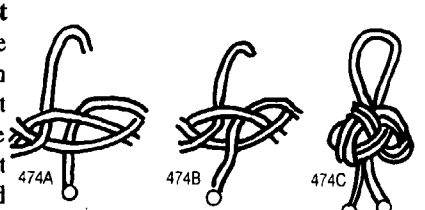
The **Carrick Bend (472)** joins two heavy hawsers, not necessarily of the same diameter, in a slim and flexible, but strong and secure knot that readily passes round capstans or through hawseholes and the like. It is easy to untie, even after high loads on heavy ropes of natural fibres. Make a turn in one rope and place the running end of the other rope on the same side of the turn as the running end of the first rope, but pointing in the opposite direction (472A). Following a consistent over–under pattern, pass the running end of the second rope round the two ends of the first rope and across the turn and its own standing part (472B). Note that the two ends are on opposite sides of the knot. Alternatively, to conform with Asher's system of making a whole series of related knots, interlock two turns of the same handedness as shown (472C) and tuck each running end back over its own standing part and up into the opposing loop with a consistent over–under pattern. Do not work the knot tight but put a firm seizing round each end and its standing part (472D).

There are several sets of lanyard and button knots based on the Carrick Bend, differing only in a few minor tucks; I describe only one set. The **Sailors**



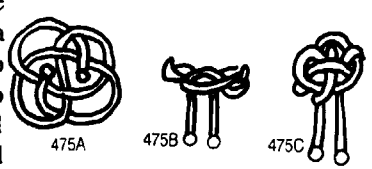
473. Sailors Lanyard Knot

Lanyard Knot (473) is a decorative knot with a loop at one end and two parallel ends at the other. It may be made so that the loop already holds a knife, keys or the like and the ends are more or less purely ornamental, or so that the loop passes over the head and objects are tied to the ends. It is convenient to tie the Carrick Bend over the hand if the cord is no more than about 7 mm diameter. Place a bight of the cord over the hand (473A). Any object to be held on the loop should be threaded and placed at the back of the hand, but if the loop is to be passed over the head a suitably sized bight should be at the back of the hand. Put a turn in the rear cord and place it over the front cord (473B). Pass the end of the front cord behind the rear cord and through the turn, picking up its own standing part (473C). This forms the Carrick Bend, which of course may be made by any other means. Pass each end down and up through the centre of the Carrick Bend and remove the knot from the hand (473D); work tight (473E).



474. Double Sailors Lanyard Knot

The **Double Sailors Lanyard Knot (474)** is readily made from 473. Note that in 473D the final tuck causes each end to enter the centre of the knot next to one leg of the loop (474A). Remove each end from the centre and tuck it beside the loop leg (474B). Each end then follows round beside this loop turn, four tucks each end, so that all turns are doubled. The ends are then tucked down into the centre of the knot which is then worked tight (474C).



475. Chinese Button Knot

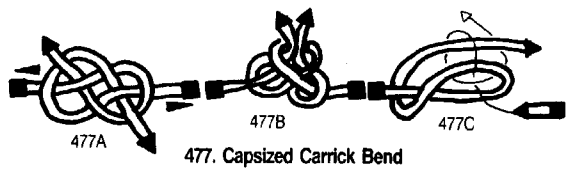
The **Chinese Button Knot (475)** can be formed as either a fairly large flat disc or a more or less spherical knob, with the two ends coming out together in the middle. To tie it, get to 473D of the Sailors Lanyard Knot; work the bight out into the knot and tighten with the knot as a flat disc (plan view in 475A, side view in 475B). To form a knob button, work the edges of the disc down round the standing parts (475C); it is better to keep the central strand (between the two ends in 475A) on top of the knot rather than allow it

to be absorbed into the middle of the knot. The **Double Chinese Button Knot (476)** is a larger knob (it is rather clumsy as a disc). Take one end of 475A and follow the other end with it, passing round the central strand. Follow right round and finish by tucking down beside the other end. This process may be repeated, though the large knot may well need a core.

476. Double Chinese Button Knot

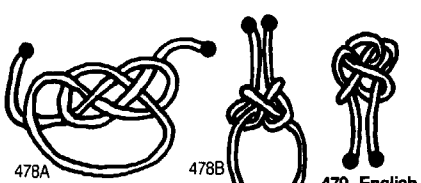
Capsized Carrick Bends

The **Capsized Carrick Bend (477)** is a bend for cord of any size from surgical gut and machine knitting wool yarn to hawsers. It is comparatively easy to untie, even after great strain or after wetting natural fibre cord. It is normally by making a Carrick Bend (472B) with not too short running ends, working no more than moderately tight (477A) and giving a jerking pull on the standing parts to capsize the knot. The knot (477B) is bulky but it is strong and secure. Heavier and stiffer ropes may be difficult to capsize by hand, so either seize the ends as in 472D or tie direct as in 477C. Make a turn in one rope and lead its running end back parallel to its immediate standing part (477C). Then take the second rope over all three parts of the first turn, into the standing end of the eye, over its own standing part and back into the eye; work tight.



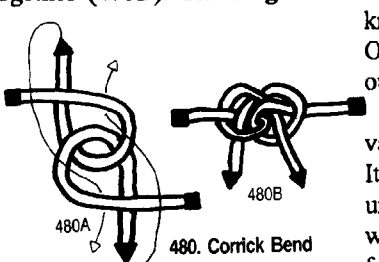
477. Capsized Carrick Bend

A simple lanyard loop and button knot can be made from the Capsized Carrick Bend. The **Oblique Carrick Loop (478)** is a lanyard loop similar to but smaller, simpler but less decorative than the Sailors Lanyard Knot (473). Make a Carrick Bend on a bight of rope (478A); this could be made as 473A–C. The bight should be threaded through anything wanted. Capsize the Carrick Bend by jerking the legs of the loop, and bring the running ends together (478B). The **English Button Knot (479)** is a more or less spherical knob on two ends. It is made from the Oblique Carrick Loop by working the bight out of the ends.



478. Oblique Carrick Loop

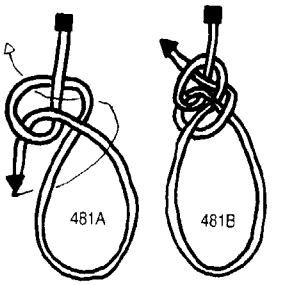
479. English Button Knot



480. Corrick Bend

The **Corrick Bend (480)** is a simple variant of the Capsized Carrick Bend (477). It makes a good secure bend, fairly easily untied even after severe strain. Start (480A) with the same formation as the Asher start for the Carrick Bend (472C) but take each

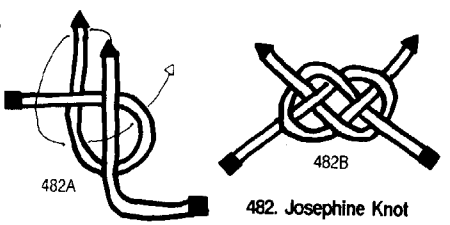
end over its standing part and down (instead of up) into the other turn and work tight (480B). A simple derivative of the Corrick Bend is the **Corrick Loop (481)**, an interesting loop with the running end passing up above the knot. Make a right-handed turn and take the running end in a right-handed the size of the final loop back into the first (481A). Then pass the running end up into the loop and with a consistent under-over pattern across the first turn, trapping the standing part (481B).



481. Corrick Loop

JOSEPHINE KNOTS

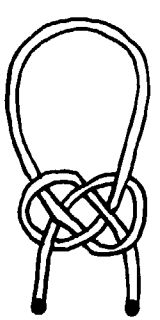
The **Josephine Knot (482)** takes maximum advantage of the decorative properties of this form by having both running ends on the same side of the knot. It is a bit weaker and less secure than the Carrick Bend (472) but this is of little importance in decorative work. Make a turn in the running end of one cord and place the running end of the other across this turn on the opposite side to the first running end but pointing in the same direction (482A). Following a consistent under-over pattern pass the running end of the second cord round the two ends of the first and across the turn and its own standing part (482B). The knot is often made in the two ends of one cord, with only a small bight. Many decorative knots can be made from the Josephine Knot, some of which I describe. I have, however, followed tradition in giving them names incorporating the word Carrick.

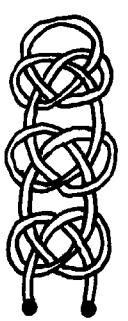


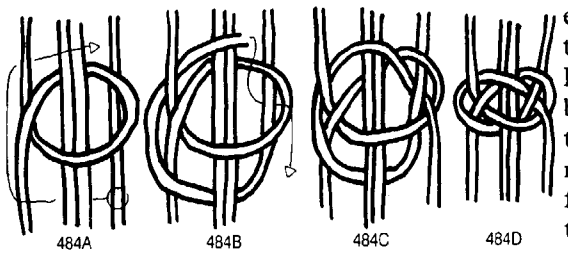
482. Josephine Knot

If you make the bight large enough to place over the neck, you have a **Sailors Breastplate (483A)**, a decorative lanyard. The same formation is much used in decorations on clothing, specially uniforms, and elsewhere. The **Chain of Carricks (483B)** is a series of Josephine knots used in a variety of decorative crafts; it makes quite an attractive band round a cylindrical object.

The **Carrick Macramé Knot (484)** makes an interesting variant in macramé, specially in interchanges (203B), including interchanges between bars. A continuous series of these knots, in effect a Chain of Carricks (483B) round a core, is a bit fussy.

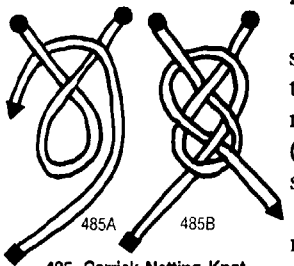

483A. Sailors Breastplate


483B. Chain of Carricks



484. Carrick Macramé Knot

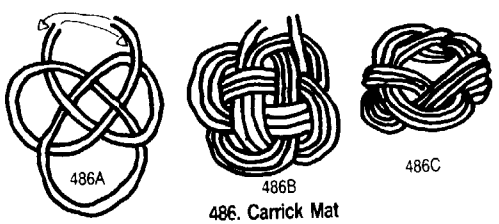
Make a turn with one end round the core, over the other cord (484A). Pass the second cord behind the core beneath the turn, over the first running end, behind the first standing part, over the core (484B), and then over the turn, picking up its own standing part (484C). Work tight (484D).



485. Carrick Netting Knot

The **Carrick Netting Knot (485)** makes a very secure and firm diagonal net very resistant to distortion. Put a turn in the loop of the previous row of netting and take the cord into the V of the turn (485A). Pass the cord over the turn, picking up its standing part (485B) and work tight.

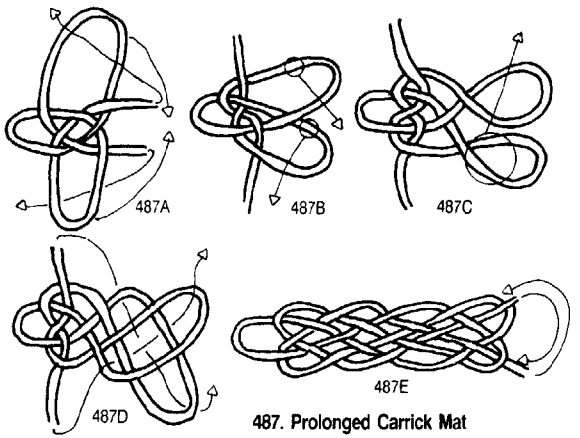
The Josephine Knot is the starting point of a number of mats, and the simplest of these, the **Carrick Mat (486B)** can be rearranged to form a **Four-Bight Three-Part Turkshead (486C)**, the same knot (464) previously made from the Millers Hitch (463). Make a Josephine Knot in the middle of the cord, with a small bight between the standing parts (486A). With each end in turn follow the other lead right round the knot, taking care to make all tucks in the same way without riding over previous turns (486B). This gives three passes for each turn, which is generally the most attractive and secure form, but of course either more or less may be used as desired. Finish by tucking the ends under the knot and stitch them to an adjacent turn out of sight from the top. To make the Turkshead, manipulate 486A to make the central square larger and the outer bights smaller, forming a ring. Follow through each end as before (486C) and secure the ends out of sight.



486. Carrick Mat

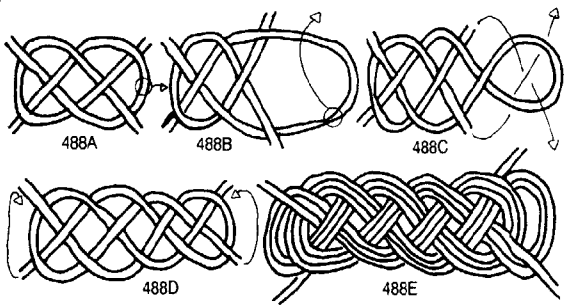
The **Prolonged Carrick Mat (487)** is a long narrow mat, capable of being made longer. Make a Josephine Knot in the middle of the cord, with long side bights and a small end bight (487A); it may be convenient to anchor the end bight to a hook or the like. Take the ends outside the knot and the side bights to the middle (487B) and put a twist in each side bight (487C); the twists maintain the over-under sequence. Note that the outside leg of one of the bights passes over its inside leg (the lower bight in 487C); place this over the other bight (487D), keeping the twists outside the overlap. Pass the ends along

the full length of these bights from the twist to the end, maintaining the over-under sequence (487E). This process (487A–E) may be repeated as desired. Finally pass each end alongside the other (making three passes in all), taking care to make all tucks the same way, and finish by trimming and stitching the ends beneath the mat.



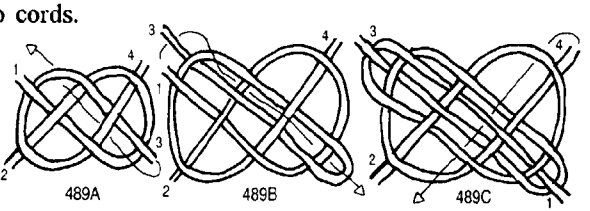
487. Prolonged Carrick Mat

The **Elongated Carrick Mat (488)** is a long thin mat, narrower than 487, that also can be adjusted to any desired length. Start with a Josephine Knot in the middle of two cords (488A). Pull out one end bight (488B) and twist it so that the over-under sequence is maintained. Pass each adjacent end across this turn and interlock in the over-under sequence (488D). This process may be repeated as desired. One end on each side should then follow its adjacent end round all tucks, to complete three passes per turn (488E), or as desired. Trim off and stitch the ends beneath the mat. The knot in its single-pass form (488D or as elongated) has been used as a decorative bend in such things as trumpet cords; it is in effect a Four-Strand French Sennit (499) tied in two cords.

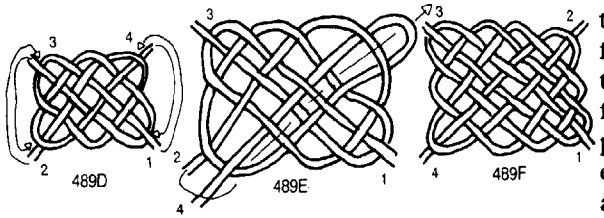


488. Elongated Carrick Mat

The **Augmented Carrick Mat (489)** is a nearly square mat that can be extended to any desired size. Make a Josephine Knot in the middle of two cords (489A). Tuck one end (3) back alongside itself (489B), then the diagonally opposite end (1) between the two legs of the bight, making a regular over-under sequence opposite to that of the bight (489C).



489. Augmented Carrick Mat



489. Augmented Carrick Mat

The first stage of the augmentation is formed by evening out the turns (489D) and following through the pairs of ends closest to each other (1 and 4; 2 and 3). The second stage is started from 489C by tucking back the other pair of strands (4 and 2) in the same way (489E,F). Finish this stage by following through (1 and 2; 3 and 4) or continue with additional stages. The more stages required, the looser should be the initial knot.

Chapter 20
TURKSHEADS

The typical Turkshead is roughly cylindrical in form, and is made from a single cord. It can be used as a decorative binding knot, whipping or seizing; as a cover for the start or finish of splices, coxcombs, sennits or coachwhipping; as a stopper or hand guard on tools or drip guard on oars. Made in rigid material, as leather, cane, wire or some solid plastics, it can form stands, serviette rings, egg cups or the like; made in suitable materials, it can form lampshades. Very versatile! Slightly modified Turksheads have even more uses, discussed later. While very long turksheads can be made, to cover handrails, the rims of steering wheels or the like, a very similar appearance can be achieved more readily by using Round Sennits (508) or Coachwhipping (509), made with many cords, but these are never as tidy at the start and finish as the bights of Turksheads.

Turksheads are characterised by three numbers: the number of **bights**, the number of "bumps" on either rim; the number of **parts** (sometimes called **leads** or **strands**), the number of times a cord goes round the core in a single-pass knot, or the number of cords found along a longitudinal line across the knot; and the number of **passes**, the number of times the cord pattern is replicated.

We have already seen that Turksheads can be made from a flat knot, as the Four-Bight, Three-Part Turkshead (486C) or from a knot tied round a core, as the same knot tied in a different way (464) or the Two-Bight Three Part Turkshead (465). Similar knots have been worked out for quite a number of Turksheads but they get very complex and difficult to remember if you are not using them frequently. If you have a specific job for a Turkshead, that is, you want to cover a specific length, diameter and so on, there is little to guide you on the specifications of the Turkshead needed for the job, that is, the number of bights and parts etc. If you only have available some published empirical instructions, then you will need a lot of trial and error, a lot of experience or a lot of luck to get a satisfactory result. The method I describe here is readily applicable to any size Turkshead and has the advantage of allowing working out the specifications of the required knot; I discuss this first.

TURKSHEADS ON PAPER

I assume that the Turkshead is required to be neither extended nor squashed, that is that the internal crossovers should be roughly at right angles, and that the various elements should fit together tightly.

Specifications

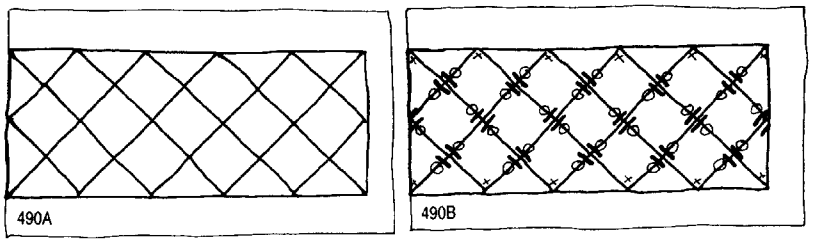
(i) Given the dimensions of the finished Turkshead (length, width, size of cord etc), what are the specifications (number of bights and parts etc)? You need to know the circumference to be enclosed by the knot, C: measure with the cord to be used, held a little slackly, with a sag of about one diameter of the cord; the length to be covered by the knot, L; the diameter of the cord, d; and the number of passes or replications wanted, n. Then the number of bights $B = 0.7\times[C/(n\times d)]$; take to the nearest whole number below, for better appearance. The distance from bight to bight, or arc length, $b = C/B = 1.4\times n\times d$. The number of parts $P = 2L/b$ (take to the nearest whole number above, for better appearance). The greatest common divisor of B and P gives the number of separate cords you will need to make the knot. Only if this is 1 (in common parlance, there is no common divisor) will the knot be a Turkshead as strictly defined; if you want to use only a single cord, adjust B or P as little as possible to achieve this. The length of cord needed is $l = 1.4\times P\times C\times n + P\times B\times n\times d$ where the last term, $P\times B\times n\times d$ is a fairly generous allowance for having plenty of slack cord while tying. Extended Turksheads are made if B is greater or P less than as calculated; squashed Turksheads are made if B is less or P is greater; the calculated l is less accurate.

(ii) Given the specification of the Turkshead, what are the dimensions? The circumference $C = 1.4\times B\times n\times d$ and the length of the knot $L = (P\times C)/2B$.

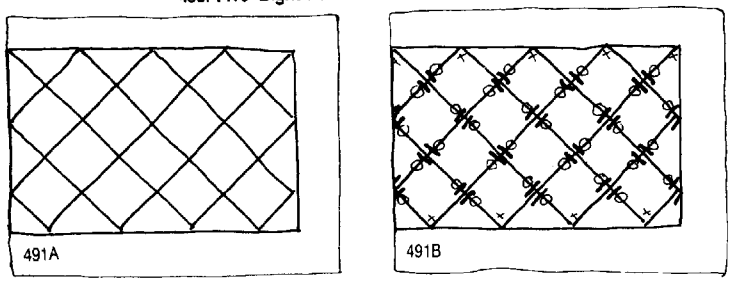
Application

The method I describe to make Turksheads is illustrated by three different knots showing the main points.

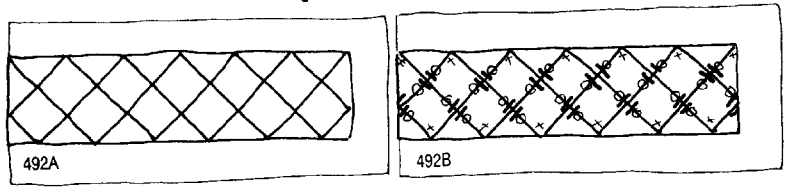
The **Five-Bight Four-Part Turkshead (490)** has an even number of parts; the **Four-Bight Five-Part Turkshead (491)** has an odd number of parts; the **Six-Bight Three-Part Turkshead (492)** has a common divisor, 3, between the number of bights and the number of parts, and so cannot be tied with a single string, but needs three cords (the common divisor).



490. Five-Bight Four-Part Turkshead



491. Four-Bight Five-Part Turkshead



492. Six-Bight Three-Part Turkshead

Obtain a sheet of paper a little wider than the required circumference, *C* of the Turkshead, and a little longer than the required length, *L*. Remember that the circumference, *C*, is measured with a slack cord. Starting from one edge near the top of the paper, draw a line *C* long, and divide it into *B* parts, each *b* long. Along the edge, draw a line *L* long, divided into *P/2* parts; in a standard Turkshead, each of these parts is also *b* long. When *P* is odd, the half part should be at the bottom of the edge, not in the middle (491A, 492A). From the lower edge, draw another line *C* long; divide it in the same way as the top line if *P* is even (490) or divide it into parts each *b* long, but starting *b/2* from the corner if *P* is odd (491, 492). The two side edges should be marked in the same way. Then draw all the diagonals, so that the papers should now appear as 490A, 491A, 492A. Note that these grid diagrams represent symbolically the run of the cord in the single pass Turkshead, when

the diagrams are joined along the side edges to form a cylinder, so that the diagonal lines continue across the joins and the top and bottom peaks represent the curved bights.

Starting at any crossover point, follow along the lines marking the crossovers alternately over and under; I use the mapping symbol for a bridge in the appropriate way (490B, 491B, 492B). Remember that the lines continue across the end join lines and that the top and bottom peaks are nor crossovers but simple curves. You only get back to the starting point when every crossover is marked in 490 and 491, confirming that only one cord is needed, but in 492 you will need to make three different starts to get every crossover marked, confirming that you will need three different cords (remember that the over-under sequence must be followed between as well as among cords).

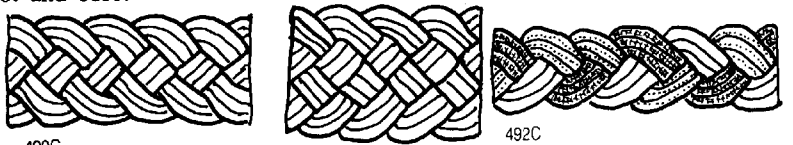
The next step depends on how you will be tying the Turkshead. If the knot will be around a core and if it is satisfactory to push panel pins or the like into the core, then mark just inside each peak (the bights), at the top and bottom. I have marked an ×. If the knot will be free standing, not around a core, or if you do not want to or cannot insert pins, then punch holes in the paper, large enough to pass the cord easily, along the line either side of a crossover marked "under"; I have marked these places ○. My diagrams 490B, 491B, 492B show the crossovers and both × for the pins and ○ for the holes. Carefully join the diagrams edge to edge with adhesive, around the core if there is one; it should be a slack fit.

If you can use panel pins, knock them in at each × and fix the cord, about one third of its length along, at one ×; this point rather than the end of the cord is recommended to minimise the amount of cord that needs to be reeved through the tucks and assumes the usual three passes; work with the longer end. Turkshead 492 needs three cords; these should be fixed at any three consecutive pins along one side. The cord should then be taken along the line from pin to pin. When you come to a crossover point already occupied by a cord, cross over or under it according to the marks. When you have completed one pass and are back to where you started (for 492, one pass for each cord), remove the pins and the paper and follow the lead cord for the required number of passes, one end in each direction, taking care to make each tuck correctly without allowing the cord to ride over its lead. Work tight and even.

While it is possible to use a removable adhesive tape instead of the panel pins, it is often preferable to use the holes if you can't use pins. Start at any hole and pass two thirds of the cord into the hole, under the adjacent crossover point and up the next hole. Continue along the line, using the holes to make all the underpasses, until you are back at the starting point (for all three cords in 492); allow slack at each of the bights. Passing the cord through the paper in this way holds the cord in its proper place throughout its pass; if the Turkshead has many parts, and so many crossover points between bights, it may be easier if you use only a couple of holes each side of the bights and just make sure that the other crossovers are made correctly, above the paper. When the

first pass is complete, tear the paper out and complete the required number of passes, using the two ends of the cord in opposite directions, and taking care to follow the lead correctly, without twists. Work tight and even.

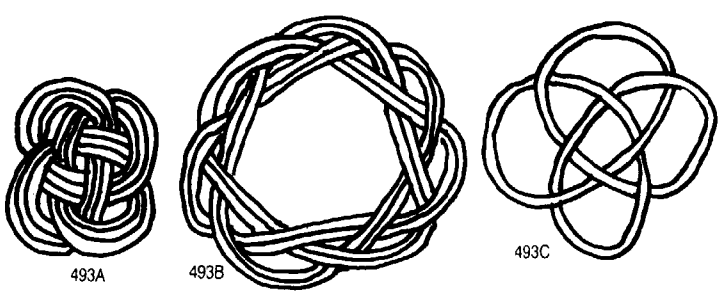
If the ends of the cord are not wanted for other purposes (see below), trim off and fasten inside the Turkshead by stitching, or using adhesive, or by a heat weld as appropriate. If the Turkshead is really tight against the core it may be sufficient to leave the ends a little longer and tuck them in between knot and core.



490. Five-Bight Four-Part Turkshead
491. Four-Bight Five-Part Turkshead
492. Six-Bight Three-Part Turkshead

The knots should now, if cut and opened out, look like 490C, 491C, 492C. Note that when more than one cord is needed to complete the knot, as 492, it is possible to use different colours for each cord. So if you want to have more than one colour in your Turkshead, choose *P* and *B* so that their common divisor is the number of colours wanted; otherwise you will need some fancy joining of cords.

TIGHTENING TURKSHEADS

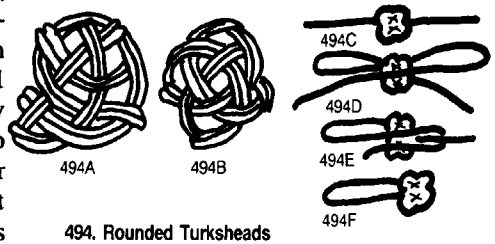


493. Flattened Turksheads

Turksheads can be tightened in a number of ways. They may be **Flattened** whilst tightening (493). We have already seen (486B) how knots with small numbers of parts and bights can be flattened to form a mat (493A). With larger numbers of, particularly, bights, **Ring Mats (493B)** can be formed. Turksheads, specially single-pass knots, can be flattened in open formation to form **Frogging (493C)**, the decorative cording applied to outer clothing, uniforms and the like, and sometimes incorporating or surrounding fastenings.

On the other hand, the Turksheads may be tightened in the **Rounded** form (494). If one end of the original cylinder is worked tight and the other left unchanged, a dome (494A) is formed, useful to cover the ends of tools or the

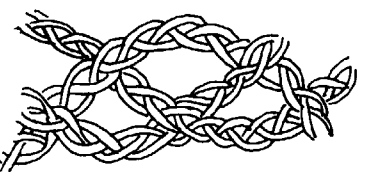
like. If both ends are drawn in, leaving the centre open, a spherical object (494B) is made, which can be used to cover a spherical core. It is advisable to use only moderate numbers, say four to seven, of parts and bights for these knots. If the ends are left out and the sphere is worked as tight as possible, a stopper knot (494C) is formed; or the ends can be tucked back through the Turkshead to form a bow on each side (494D), a decorative knob in a bight, used for binding curtains or the like. Finally, one end may be left short and the other tucked into a bight on each side (494E); the short end is then trapped in the second bight, with both ends trimmed off inside the knot, maybe with a stitch or two, leaving a knob on the end of a loop, perhaps useful as a button (494F).



494. Rounded Turksheads

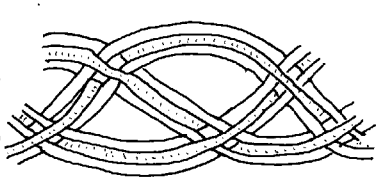
OTHER FORMS OF TURKSHEADS

Turksheads can be made with other things than cords; straps, tapes or ribbons can be used, with only one pass. Sennits can also be used, but you are then using more than one strand and have a lot of ends to tuck away. Alternatively, make the plait as you make the Turkshead. The **Sennit Turkshead (495)** is tied by making a two-pass Turkshead with the desired number of parts and bights. Make the third pass to form a threefold plait in the same way as was used to extend three-part Turksheads (464, 466). It is best to use a soft flexible cord or this knot is very nubbly.



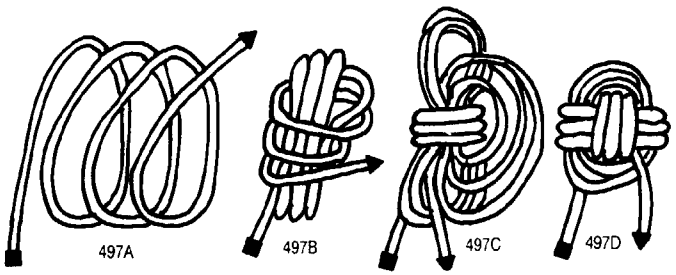
495. Sennit Turkshead

A Turkshead may also be extended. The **Globe Knot (496)** forms a large spherical knot, best tied round a core. An ordinary two-pass Turkshead is made, leaving plenty of slack. The third pass is made between the first two, passing over the strands the lead strands go under and vice versa (496). Then double or triple the knot with extra passes from the beginning.



496. Globe Knot

The **Monkeys Fist (497)** forms a weight at the end of a heaving line; it can be tied round a core to provide greater weight. It appears very like a Three-Pass, Three-Bight, Three-Part Turkshead but is tied with a single cord.



497. Monkeys Fist

Make three turns (497A); if the core to be used is large compared to the rope, four or even more turns might be needed. Starting with a riding turn, make three (or other) turns round the first (497B); these should be kept loose if a core is to be used, otherwise made tight. Then make three (or other) turns round the second set but inside the bights of the first set (497C). Insert the core if any and work tight, a little at a time, keeping the turns parallel and even (497D). Join the running end to the standing part with an eye splice if the rope is suitable, or a bowline or the like. The loop should be kept small if there are obstructions it could catch on, but for rescue it might be better to keep the loop long enough to insert the arm if not the shoulders.

Some people make Turksheads round a rope to use as hand or foot holds, passing the ends through the centre of the rope for security. However, it might be better to pass two cords through the rope, leaving equal ends, and tie four-strand Manrope Knots (239) or Double Diamond Knots (233) round the rope, tucking the ends back into the rope.

Chapter 21
SENNITS

There is an enormous number of sennits possible, even if the number of strands is restricted to, say, no more than a dozen. The ones I have selected are all simple to tie by methods readily extendible to other numbers of strands; some are capable of other applications. I have used formulae to explain the method of tying, where n is the total number of strands, L and R refer to the strands that are at any one time on the left or right hand sides, and o and u stand for passing over or under the next strand. You will sometimes find that the first members of two or more sennit systems are identical; for example, a

Three-Strand Common Sennit is identical to a Three-Strand French Sennit, likewise the Four-Strand Round Sennit is identical to the Four-Strand Square Sennit, though in all these cases the sennits with more strands are very different. I give a full explanation of at least one example in each system so that you can follow the system.

A sennit can be made wider by increasing the number of strands in the formula, but the difficulties of keeping the strands in the right order increases; another way is to use double or triple or even quadruple strands instead of the single strands of the formula. Flat sennits made with double strands or more have different appearances when changing direction depending on whether the strands are kept parallel (498A) or are folded (498B). Of course, if you are using flat tapes, thongs, straw or the like instead of round cords, you will probably need to use folded curves (498C).

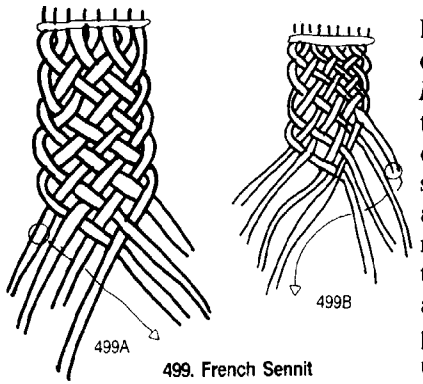
498. Curves in Sennits

Aside from the flat tapes and so on already mentioned, sennits may be made from a wide variety of materials, from monofilament fishing line to laid rope, from plastic tubing to braided rope. Strands of different colours may be used, giving interesting patterns; note that quite different patterns may appear if you use colours in the order ABAB or AABB and so on. For learning and practice, it is best to use a smooth and very flexible cord that is not very compressible.

It is usually best to start with the cords held in a row in a clamp of some sort; large spring paper clips, rods held together with rubber bands or engineers' vices have all been used. You may need to use intermediate clamps as the sennit lengthens, specially if it is also wide. Sometimes it is worth pinning the strands down from time to time on a cork board or the like. Care must be taken to keep all strands in their correct order; this is what makes the more complicated sennits troublesome to make. Work tight after every few passes; it gets too difficult to take up a lot of slack over a long length. In many instances, it is better to work sennits tight by pulling on the bights at the edges of the sennit rather than the ends of the strands. Occasionally you may find some sennits easier to tie upside down to the methods I give, that is tuck under when I say over and vice versa.

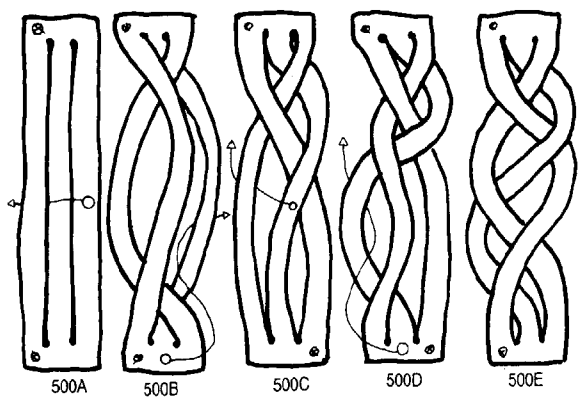
To start and finish a sennit you will need either to cover the ends in some way or to work the ends back into the weave for a few tucks after shaping the end as desired. If you are attaching the sennit to a buckle or the like, you can start with Cow Hitches (379) round the buckle shank in the middle of the strands, or use Clove Hitches (372) in the bight, or in the running end with the end seized to the standing part.

FLAT SENNITS



499. French Sennit

The most straightforward sennit is the **French Sennit (499)**. For odd numbers of strands, three or more, the formula is *L: o1, u1, o1* . . . for *(n−1)/2* crossings, then *R: o1, u1, o1* . . . for *(n−1)/2* crossings. Thus for a seven-strand sennit (499), take the left-hand strand and tuck it over the first strand to its right, under the second and over the third, a total of (7−1)/2 = 3 crossings, and then take the right-hand strand and pass it over the first strand to its left, under the second and over the third. For all even numbers of strands, four or more, the formula is: *L: o1, u1, o1* . . . for *(n/2)* crossings, then *R: u1, o1, u1* . . . for *(n/2)−1* crossings. Thus for an eight-strand sennit (499B), take the left-hand strand over the first strand to its right, under the second, over the third and under the fourth, a total of 8/2 = 4 crossings; then take the right-hand strand under the first strand to its left, over the second and under the third, a total of (8/2)−1 = 3 crossings.



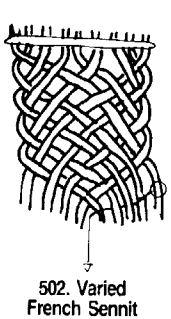
500. Strap Sennit

The **Strap Sennit (500)** is a three-strand French Sennit tied in a slit leather strap or the like. Two slits are needed, to form the three "strands" (500A). Work the right-hand strand over the centre and under the left-hand strand (500B). Pass the base through the gap next to the centre strand, reversing it sideways (500C); I have not drawn the twists in the strands. Tuck the centre strand under the original right-hand strand (500D). Again pass the base through the gap next to the centre strand, turning it the right way round again (500E). Either even up the twists or work them to the top and repeat the process.

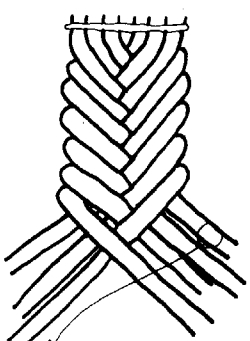
The **Extra-Tuck French Sennit (501)** is like the French Sennit except that one or more strands in the middle of the sennit pass straight along the length of the knot, not from side to side; this is approaching the style of the multi-weft Woven Sennits. The straight strands can be of different colours or sizes to the weaving ones. They are formed by making one or more extra crossings. For example, to make an even-numbered French Sennit with one straight strand, the formula is *L: o1, u1, o1* . . . for *(n/2)* crossings; *R: u1, o1, u1* . . . for *(n/2)* crossings, that is, a total of one more crossing than in the ordinary French Sennit (499). An Eight-Strand Sennit is shown in 501, where the left-hand strand is passed over the first strand to its right, under the second, over the third and under the fourth (which will be the straight strand). Then the right-hand strand goes under the first strand to its left, over the second, under the third, and over the fourth. If the formula had *L: (n/2)+1* crossings and *R: (n/2)* crossings, there would be two straight strands and so on; the limit would be a Woven Sennit (513) with one weft and *(n−1)* warps. Similarly, for odd numbers of strands (the formula has one extra crossing from 499), the limit then being a woven sennit with two wefts and *(n−2)* warps.

501. Extra-Tuck French Sennit

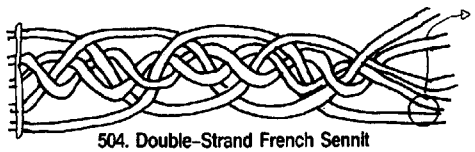
The **Varied French Sennit (502)** has the crossovers over more than one strand. It is most readily applicable with fairly wide sennits with an odd number of strands; this kind of sennit with an even number is asymmetrical. The total number of strands crossed (over or under) on either side must be equal to *(n−1)/2*. A nine-strand sennit (502) with the formula *L: o1, u2, o1; R: o1, u2, o1*; note that the total number of strands crossed on each side = 1+ 2+ 1 = 4 = (9−1)/2. Quite interesting effects can be obtained with wide knots, with the sennit bunching up where two or more strands are crossed, thinning where only one strand is crossed. The limit is obtained when there is only one crossing on each side. This is the **Common Sennit (503)** whose formula is: *n* odd, three or more; *L: o (n−1)/2; R: o (n−1)/2*. A Seven-Strand Common Sennit is shown (503) where each strand crosses 3 = (7−1)/2 others. A slightly skew version can be made with even numbers of strands, four or more, where the formula is *L: o (n/2); R o [(n/2) − 1]*. The Varied method can also be applied to the Extra-Tuck French Sennits.


502. Varied French Sennit

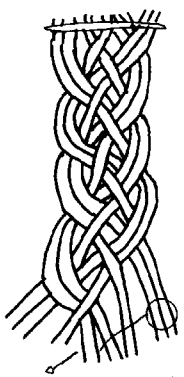
Other series of sennits can be formed by using more than one strand for working. The symmetrical ones tend to heap up into more or less semi-cylindrical shapes, though they can be squashed flat. I give two examples of these and one of an asymmetrical sennit.

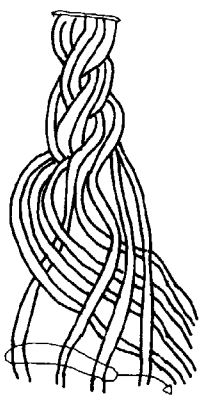

503. Common Sennit

The **Double-Strand French Sennit (504)** works with odd numbers, five or more, of strands. The formula is *L:* take 2 strands *o1, u1, o1* . . . for *(n−1)/2* crossings; *R:* take 2 strands *u1, o1, u1* . . . for *(n−1)/2* crossings. The


504. Double-Strand French Sennit

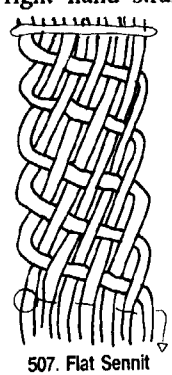
five-strand version, perhaps the most attractive, is in 504: take two left-hand strands over the first strand to their right and under the second (4/2 crossings), then take the two right-hand strands under the first strand to their left and over the second. All the sennits in this series have a relatively tight twist in the middle, with longer twists at the edges. Some experiments at making similar sennits with even numbers of strands (both *L* and *R*:take 2 strands *o1, u1, . . . (n/2)−1* crossings) were interesting: with eight strands, two separate sennits are made at the same time, one with three strands, the other with five.


505. Double-Strand Herringbone Sennit


506. Triangular Sennit

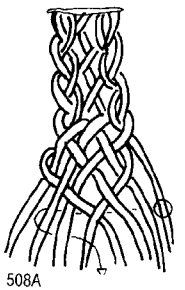
The **Double-Strand Herringbone Sennit (505)** works with even numbers of strands of six or more. The formula is : *L:* take two strands *o [(n/2)−2], u1; R:* two strands *o [(n/2)−2], u1*. The eight-strand version is shown in 505; pass two left-hand strands over the next two (8/2 − 2 = 2) to the right and under the next one; then the two right-hand strands over the next two to the right and under the next one.

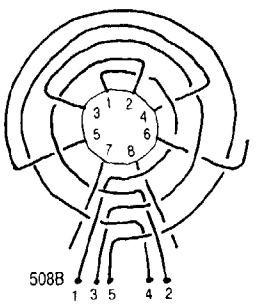
The **Triangular Sennit (506)** has one side thicker than the other. The formula for even numbers of strands of four or more is: *L*: take *[(n/2)−1]* strands *o1; R*: take *[(n/2)−1]* strands *o (n/2)*. The eight-strand version is shown in 506: take three left-hand strands (8/2 − 1 = 3)) over the next right, then take three right-hand strands over the next four (8/2) to the left.


507. Flat Sennit

All these sennits work first from the left, then from the right. The **Flat Sennit (507)** works from one side only. It can be made identical in appearance to the French Sennit (499), but is usually made to look a bit different. It can be used for any number of strands, three or more; work from one side only, taking each strand in turn over one, under one to the other side. The seven-strand version is shown in 507: take each left-hand strand in turn over the first strand to the right, under the second, over the third, under the fourth, over the fifth and under the sixth.

HOLLOW SENNITS

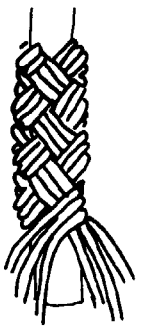

508A



508. Round Sennit

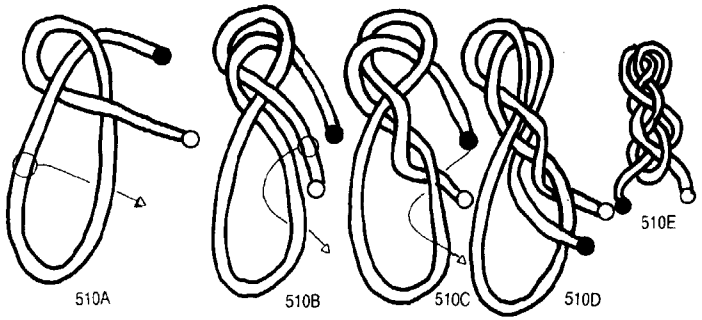
The **Round Sennit (508)** can be used as a solid sennit or as a hollow sennit round a core. It can be made with even numbers of strands of four or more, or, with one uneven tuck, with odd numbers of strands of five or more. The formula for even strands is : *L* go behind and to the right *(n−2)* strands, come up and go to the left, *o1, u1, o1 . . [(n/2)−1]*crossings; *R:* go behind and to the left *(n−2)*, come up and go to the left *o1, u1, o1...[(n/2)−1]* crossings. So in an Eight-Strand Round Sennit (508A), the left-hand strand passes to the right under six strands (8−2 = 6), comes up and crosses the over first strand to its left, under the second and over the third (8/2−1 = 3 crossings), and the right-hand strand (508A) passes to the left under six strands, comes up and passes over the first strand to its right, under the second and over the third. For odd numbers of strands, the formula is *L*: behind to the right *(n−2)* strands, up and to the left *o1, u1, o1 . . . [(n−1)/2 −1]* crossings; *R:* behind to the left *(n−3)* strands, up and to the right *o1, u1, o1 . . . [(n−1)/2 −1]* crossings.

The same formula can be used for tying round a core if all strands can be worked to the front, and the instruction "go behind" is interpreted to include the core. If the strands form a tight ring round the core, it is easier to start from the middle of the back of the core and use the formula *L: u1, o1, o1 . . . (n/2)* crossings to the right, and *R: u1, o1, u1 . . . (n/2)* crossings to the left. It is often convenient to do much of the interweaving in front where you can see things, and work tight after a few steps. 508B is a diagram of the movements of the first five strands of an Eight-Strand Round Sennit round a core. The formula for odd numbers of strands is *L: u1, o1, u1 . . . (n − 1)/2* crossings to the right; *R: u2, o1, u1, o1 . . . (n − 1)/2* crossings to the left.


509. Coachwhipping

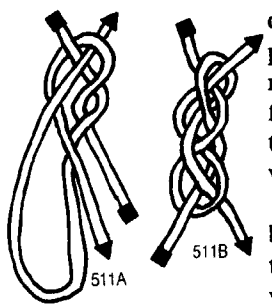
Coachwhipping (509) is a decorative covering of a cylindrical core; it is easier to tie than a long Turkshead, which it resembles. It is essentially a four-, six-, or eight-strand Round Sennit with each "strand" consisting of two, three or four individual cords, or of canvas or leather straps. The start and finish are best covered with a Whipping or a small Turkshead. The Four-Strand Round Sennit can be readily made with two or three cords per strand by a single person, but the more complex Coachwhippings are better made by two people, one working in

front with the crossovers as in 508B, the other mainly working behind the core. If you want the finished Coachwhipping to be close and really tight, it is best to make the sennit using one less cord than you really want, and then, using a needle or pliers or forceps, insert the extra cord into place.



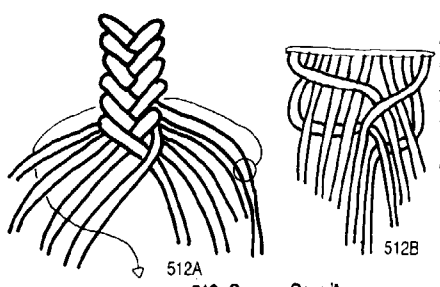
510. Single-Strand Round Sennit

The **Single-Strand Round Sennit (510)** forms a short length of what appears to be Four-Strand Round Sennit. Make a turn with one leg of a bight and place the other leg through it (510A) to maintain an over one-under one sequence. Twist the bight, still maintaining the sequence (510B). Pass the first end into the bight (510C), followed in the opposite direction by the second (510D). This constitutes one pass of the sennit, and the whole process may be repeated as desired, though the twist in the cord forming the bight may have to be worked out from the end from time to time. Two complete passes, worked tight, are shown in 510E.



511. Round Sennit Bend

The **Round Sennit Bend (511)** is a decorative bend based on the Round Sennit; it can be extended to any length. Make a turn with one cord and interweave the other cord as shown in 511A. Twist the bight and tuck in both ends of the other rope as in 510A–510D; work tight (511B), or extend as desired.



512. Square Sennit

The **Square Sennit (512)** is a good decorative sennit, square in cross-section. The number of strands must be a multiple of four. The formula is *L* go behind and to the right *[(3n/4)–1]* strands, then up and to the left go over *(n/4)* strands; *R*; go behind and to the left *[(3n/4) – 1]* strands, then up and to the right over *(n/4)* strands. Thus for an Eight-Strand Square Sennit (512), pass the left-hand strand behind five (6 – 1) strands to the right, then up and over to the left two strands (8/4), then the right-hand strand behind five strands to the left, and up and over two strands to the right (512A). An alternative way of tying is shown in 512B, where the formula is: *L: o (n/2); R o [(n/2)–1]; L: u (n/2); R: u [(n/2)–1]* and repeating. It is best tied round a core, which may be round or square, by starting at the rear of the core in a similar way to 508B, but using the formula: *L: u (n/4), o (n/4)* to the right; *R: u (n/4), o (n/4)* to the left.

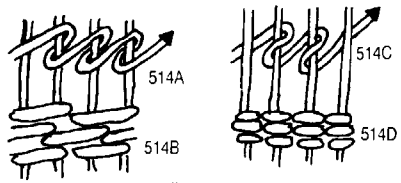
WOVEN SENNITS

Woven sennits consist of one or more warps (usually at least two) that run the whole length parallel to each other without moving from side to side, and one or more wefts that do move from one side to the other and back. It is relatively easy to form patterns by putting warps in pairs, threes and so on, and this is readily changed so that, for example, in wide enough sennits letters could be formed. Wefts can also be used in pairs or the like, but it is usual to keep such pairs together for the whole sennit. It is also possible to use crossing knots, from a simple turn to a Clove Hitch, either at every crossing or in a pattern; indeed, Cavandoli work (378) could be considered a complex woven sennit with Clove Hitches at every crossing, sometimes in the warp, sometimes in the weft. Considerable use of colour in the different strands is possible. I pay little attention to these variants below, but show how different numbers of wefts can be used to give variations in, particularly, the edges of the sennits. It is easy to make many variations on these themes.

The **Single-Weft Woven Sennit (513)** can use any number of warps, at least two. Just pass the weft over the first warp, under the second and so on to the edge, then pass it right round the last warp and back. To form such a sennit round a core, you need an odd number of warps passing along the core and pass the warp over the first strand, under the second and continue round and round the core. The weft may be smaller in diameter or softer than the warps for a tighter weave.

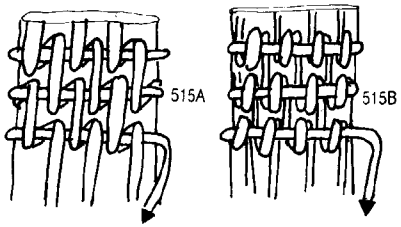
513. Single-Weft Woven Sennit

Pointing (514) was originally used to protect a pointed end on a rope that was to be passed through a block or the like, but can be used round any core. Again originally, the warps were some of the yarns of the rope being pointed, the rest being scraped to a taper; the weft was a separate cord, often the cord used to whip each end of the sennit. However, these restrictions need not apply in the general case. There should be an odd number of warps; it is often convenient to have both ends of the warps secured to the core.



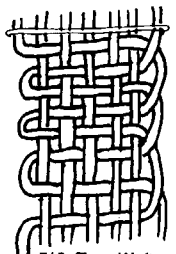
514. Pointing

In **Overhand Pointing**, the weft is passed over the first and second warps, back under the second, and over the second and third and so on round and round the core (514A), so that when tightened there are long overlapping strands like brickwork (514B). In **Underhand Pointing**, the weft is passed under the first and second warps, back over the second and under the second and third and so on (514C), resulting in smaller parallel bars (514D).

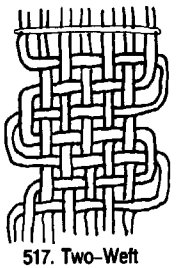


515. Spanish Hitching

Another woven covering for a core is **Spanish Hitching (515)**, but here the warps make a turn round the weft instead of vice versa. The weft still goes round and round the core, but at every crossing of the warps, a turn is taken. In Overhand Spanish Hitching (515A) the weft passes under the warps, so that the part of the warp showing covers two passes of the weft, but in Underhand Spanish Hitching (515B), the weft passes over the warps and the part of the warp showing covers only one pass of the weft.

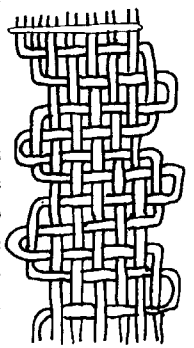

516. Two-Weft Alternate Woven Sennit

The **Two-Weft Alternate Woven Sennit (516)** has even edges, but different on the two sides. It is in the Extra-Tuck French Sennit series (501). For odd numbers of strands, five or more, the formula is *L: o1, u1, o1, . . . (n–2)* crossings, *R: o1, u1, o1, . . . (n–1)* crossings. Thus the seven-strand version (516), pass the left-hand strand over the first strand on its right, under the second, over the third, under the fourth and over the fifth (5=7–2 crossings), then pass the right-hand strand over the first strand on its left, under the second, over the third, under the fourth, over the fifth and under the sixth (6=7–1 crossings) and continue. The formula for even numbers of strands, four or more, the formula is *L: o1, u1, o1, . . . (n–2)* crossings; *R: u1, o1, u1, . . . (n–1)* crossings.


517. Two-Weft Parallel Woven Sennit

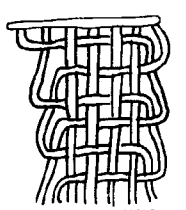
The **Two-Weft Parallel Woven Sennit (517)** has a more bumpy edge. For odd numbers of strands, five or more, the formula is *L: o1, u1, o1 . . . (n–1)* crossings; *R* use the second from the right: *u1, o1, u1 . . . (n–2)* crossings; *R: o1, u1, o1 . . . (n–1)* crossings; *L* use second from the left: *u1, o1, u1 . . . (n–2)* crossings. Thus the seven-strand version (517) has the left-hand strand passing over the first strand to its right, under the second, over the third, under the fourth, over the fifth, under the sixth (6=7–1 crossings); the second strand from the right (the original right-hand strand) passes under the first strand to its left, over the second, under the third, over the fourth, under the fifth (5=7–2 crossings); the new right hand strand then passes over the first strand to its left, under the second, over the third, under the fourth, over the fifth and under the sixth; using the second strand from the left, pass under the first strand to its right, over the second, under the third, over the fourth and under the fifth. For even numbers of strands, four or more, the formula is *L: o1, u1, o1 . . . (n–1)* crossings; *R* use the second from the right: *o1, u1, o1 . . . (n–2)* crossings; *R: u1, o1, u1 . . . (n–2)* crossings; *L* use the second from the left: *o1, u1, o1 . . . (n–1)* crossings.

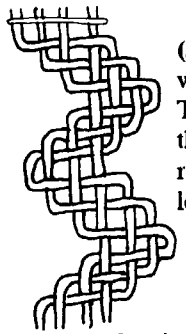
The **Two-Weft Peaked Woven Sennit (518)** has more pronounced peaks at the edges. For odd numbers of strands, five or more, the formula is *L: o1, u1, o1 . . . (n–1)* crossings, repeat left again, then the two right strands similarly. Thus the seven-strand version (518), the two left-hand strands, one after the other, pass over the first strand on their right, under the second, over the third, under the fourth, over the fifth and under the sixth (6 = 7–1), then do the same with the two right-hand strands, one after the other. For even numbers of strands, four or more, the formula is the same except that the right-hand strands move *u1, o1, u1 . . .*.


518. Two-Weft Peaked Woven Sennit

Similar alternate, parallel, peaked and more complex woven sennits can be worked out for three, four, or more wefts. I have found it a good idea to work out these sennits by drawing them with all right angles, as in the diagrams above. I wish to call attention to only two of these.

The **Three-Weft Mounded Woven Sennit (519)** has more even edges than many, particularly with odd numbers of strands, including the wefts. For odd numbers of strands, five or more, the formula is *L: o1, u1, o1, . . . (n–2)* crossings, *R: o1, u1, o1, . . . (n–2)* crossings. The seven-strand version (519) takes the left-hand strand over the first strand to its right, under the second, over the third, under the fourth and over the fifth (5=7–2 crossings), then take the right-hand strand over the first strand to its left (the strand you have just been working with), under the second, over the third, under the fourth and over the fifth and continue. For even numbers of strands, six or more, the formula is *L: o1, u1, o1, . . . (n–2)* crossings, then *R: u1, o1, u1, . . . (n–2)* crossings; a six-strand version is illustrated in A63.


519. Three-Weft Mounded Woven Sennit



520. Four-Strand Three-Weft Peaked Woven Sennit

The **Four-Strand Three-Weft Peaked Woven Sennit (520)** has the appearance of a three-strand Common Sennit woven round a single strand, a rather attractive wavy band. Three left-hand strands in turn pass over the first strand on their right, under the second and over the third, then the three right-hand strands in turn pass under the first strand on their left, over the second and under the third.

PART FOUR

DESIGNER KNOTS

A few well-tried versatile knots that serve their functions well and efficiently and that you know you can tie easily and in any circumstances are safer and more useful than a large number of specialised knots that you have to think about tying. For sure, in any narrow speciality, the few specialised knots customarily used can be very valuable if you learn them well. The key is always that you know them so well that you can tie them correctly and in the correct application in any circumstances without having to pay laborious attention or refer to books or the like.

But as a handicraft there can be a lot of value, and much gain in one's self-esteem, in learning additional knots; and a lot of fun in experimenting in knot construction and inventing, or reinventing, knots that you have never seen before. And you may well discover some knots that are useful to you and that you can make your personal speciality or share with your friends. As new ropes are developed with new properties of stretch, energy absorpton and handling, to name no more, there will be an increasing need to re-evaluate old knots and try out new ones. You may also need to experiment with non-traditional knots to meet the needs of the new kinds of rope that come on the market from time to time. However, thorough testing and experience are needed before recommending novel knots for general use, specially if anything important is involved in their application.

Of course, if you are using knots mainly for their decorative properties, there is virtue in variety and in novelty, and excellent reason to experiment with something different.

This Part is intended to give you some help in the search for novelty, partly by calling attention to a number of expedients used to modify knots already discussed and that can be used as models on how to set about your search.

Chapter 22
THE SEARCH FOR DIFFERENT KNOTS

While many novel knots have been developed through more or less random fiddling with bits of rope, it is possible to follow some logical strategies.

SIMPLE KNOTS

Knots out of Context

Perhaps the simplest way of discovering knots new to you is to look at knots with unfamiliar applications or in unfamiliar cultural settings. Probably the most fertile fields of new knot development at the present time are those concerned with mountaineering, climbing, caving and rope rescue on one hand and with angling on the other. While I have included in this book a number of recently introduced fishing knots, most of my climbing knots are relatively long established and well tried. Many of these knots can be used in other applications. Many fishing knots involve multiple turns; when tied in rope you may find fewer turns satisfactory.

Other trades, crafts and activities have also, over the years, developed specialist knots, some of which may well be capable of other applications. Likewise you will find other knots in other countries; fishers, farmers, weavers and construction workers are often the best sources, but don't forget scout groups and the like. When you travel, look at the knots around you. Many European countries have good books on knotting which contain some knots that are not at all common in the Anglo-American literature, and if they are well-illustrated, language difficulties should be minimal. There are Chinese and Japanese books on fancy work, but otherwise there is only a little indigenous knotting literature in Asian, African or Latin American countries.

Simplest Variants of Knots.

Look at the very simplest variants of knots. For example, what happens if you simply switch the running ends and the standing parts? A Slip Overhand Knot (64) converts to an Overhand Noose (77). Look at the various ways of stabilising these knots—such as 65–68, 71,72,74; compare with 78–81—can you think of any other ways? Are any of the tricks used for Slip Overhands applicable to Nooses? Can you use any of these tricks on other slip knots, or other nooses? Then how about the Overhand Bend (130A) and the Ring Knot (132), or the Catspaw on the Running End (207) and the Ring Hitch (208); can you find similar pairs of bends or hitches with the ends switched?

Another simple variation is multiple Overhands in the Open and the Grapevine forms? Some effects of changing one to the other are seen in 94 and 95—there surely must be others.

Extra Tucks and Turns in Hitches

Extra tucks here and there can alter the character of a hitch; mostly this happens to snug hitches, but the same treatment can be applied to loose hitches. An extra turn usually adds extra security without otherwise changing the character of the hitch. There are many possibilities, difficult to systematise, and I simply list some of the examples listed in this book; try out similar moves from a different starting point.

Extra tucks in a two-turn snug hitch start from a Clove Hitch (372) and give a Spar Hitch (462), Millers Hitch (463), Constrictor Knot (150), Strangle Knot (155), Gaff Topsail Halyard Bend (350), Stunsail Halyard Bend (353) or Hook Hitch (355). Extra turns give a Magnus Hitch (450), a Jammed Clove Hitch (375), Topsail Halyard Bend (354) or Net Line Hitch (471). Other, more simpler extra turns give such knots as the Double Man Harness Hitch (55), Double Marline Hitch (145), Double Constrictor Knot (152), Two-Twist Constrictor Knot (153), Double Strangle Knot (157), Double Timber Hitch (301), Double Blackwall Hitch (320), Double Pile Hitch (326) or Double Rolling Hitch (460). With a change of handedness in the parts, we have a Cow Hitch (379), an Ossel Hitch (467), Snug Hitch (468), Two-Tuck Snug Hitch (469) or, with an extra turn, a Magnus Cow Hitch (451).

Extra Tucks or Turns in Loops and Bends

If a knot is suspected of not being quite secure enough for its application, several moves can be made to improve it. The simplest is to double one or more of the turns; examples in this book include the Double Bowline (415), Double Sheetbend (413), Rivermans Bend (412), Double Fishermans Knot (109), Double Fishermans Loop (112), Double Riggers Bend (129), Surgeons Knot (173) or Double Surgeons Knot (174). Other kinds of extra turns are found in the Enhanced Bowline (421) or Sheetbend (422), or the Locked Spanish (360) or Portuguese (444) Bowlines.

More distinctive knots are obtained by tucking the running end(s) into the interior of the knot. Examples in this book include the Tucked Overhand Single Loop (68), Halter Hitch (79), Anglers Loop (71), Algonquin Bowline (74), Tucked Reef Knot (171), Turn-Tucked Sheetbend (418), Loop-Tucked Sheetbend (419) or Tucked Bowline (420).

Loops and Bends

Many a loop shares the same basic formation as a bend; the Bowline and the Sheetbend are the best-known examples, but there are many more. An easy way of recognising this is to make a loop and cut the bight; often the result can be useful as a bend; likewise, a useful loop can often be produced by joining the running end of one rope in a bend with either end of the other.

A number of examples of these processes can be seen in some of the loops and bends of the Sheetbend–Bowline family discussed in Chapter 17. A comprehensive study of this family in its simplest form is shown in 521, with 24 knots based on the form in 521A, with a left-handed turn; a similar series based on 521Z with a right-handed turn, could be constructed just as readily.

The basic formation, first mentioned in 394, is repeated in 521A. Then each row contains the knots produced when each of the ends A, B, C, D (521A) becomes in turn the standing part. First there are two loops, then two bends, then a hitch to a loop, then a bend to a continuous rope.

Examination of 521B–521Y shows that bends D and P, E and W, K and Q, J and V are in fact identical, so that there are only four different bends in the series. Some other knots are nearly the same and would be expected to function in very similar fashions. Loops B and C, H and I; bends D and E, J and K; becket hitches R and X and T-bends S and Y are very similar. However, it is generally believed that 521C is slightly less secure than 521B (see 400) and that 521D is slightly less secure than 521E (see 395) and it may well be that similar results would be found with the other pairs. Then several of the knots can be made to capsize fairly readily, depending on the rope used and the strain applied. Loops N, O, T, U can be made to capsize to nooses, and T-bends G and M to sliding knots. These capsized versions might well be useful in their own right: for example, loop O capsizes to a Crabbers Eye (88).

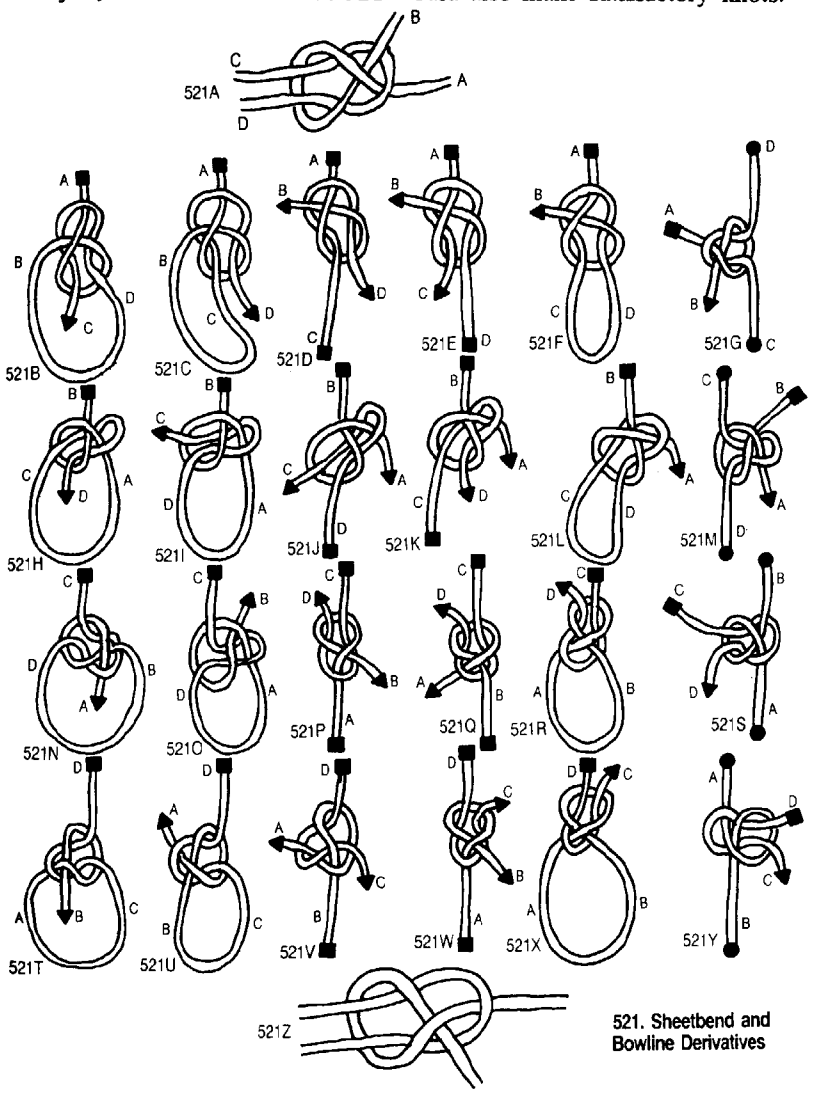
The similar series of knots based on 521Z, with the basic turn of opposite handedness, could be expected to be functionally identical to the present series, except that some small, perhaps very small, differences might be expected when using laid rope of handedness similar to or different from that of the turn. The way I normally use to tie various Sheetbend/Bowline variants seems to come out with knots of varying handedness. Consequently, when I looked at the examples 521B–521Y to see what knots I already had mentioned in this Book, I found I had several based on 521Z rather than 521A. Allowing for this, I list my examples.

521B is represented by the Sailors Bowline (400C), also 402; 405; 409.
521C is represented by the Cowboys Bowline (400D).
521D or P is represented by the Sheetbend (395B) and also 401; 404; 406.
521E or W is represented by the Left-handed Sheetbend (395C).
521F is represented by the Becket Hitch (396A).
521G or M is represented by the Mesh Knot (397).
521O is represented by the Locked Crabbers Eye (88B).

521H/E is the "Eskimo Bowline" (unknown to Warn...
521J/K is the "Lapp Bowline" (or Guide Knot 427) to Warn...

521R or X is represented by the Fly Knot (407C).
521S or T is represented by the T-Bend (403), and also 407B.
521U is represented by the Ring Bowline (399), also 408.

Maybe, some other knots in 521 would also make satisfactory knots.



521. Sheetbend and Bowline Derivatives

Other loop/bend series can be checked with profit. You will seldom find 24 possible satisfactory knots, usually many fewer. Of the knots mentioned in this book, there are two loops and a bend in the Alpine Butterfly Loop (123) family: Alpine Butterfly End Loop (126) and the Alpine Butterfly Bend (124).

Single pairs of a loop and a bend include the Blood Dropper Loop (56) and Blood Knot (57); the Tucked Overhand Single Loop (68) and the Binder Turn (70); the Matthew Walker Loop (115F) and the Matthew Walker Bend (115D); the Corrick Loop (481) and Corrick Bend (480); the Fishermans Loop (104) and Fishermans Knot (103) and their corresponding Double Fishermans knots (112 and 109); and the Fishermans Eight Loop (304) and the Fishermans Eight Knot (303).

Order and Direction in Hitches

Hitches, whether loose or snug, that consist of two or more parts can give derivatives with the parts in different order, direction or handedness. Some of these variations have been well studied, but a lot remain. A Clove Hitch (372) with a change of handedness is a Cow Hitch (379); the corresponding loose hitches are Two Half Hitches (337) and the Bucket Hitch (347). But in this situation, the hitches can change in direction also, giving a Buntline Hitch (344) and a knot I have not tried, a Bucket Buntline.

Further possibilities arise when the two parts differ. Thus a Magnus Hitch (450) and its derivative with a change of handedness, the Magnus Cow Hitch (451) also have variants where the pull is on the running end instead of the standing part of the basic knot. The corresponding loose hitches are: the Midshipmans Hitch (446) and, arranged in different order, the Midshipmans Back Hitch (447), both of which can have a change of handedness (Midshipmans Bucket Hitch, 448 and an untried knot) and all four can have a change in direction (the Jam Hitch, 449 is the only one entered in this book).

There is another series, expected to be identical in function except perhaps when tied in or on laid rope, with the initial part of the above knots differing in handedness.

Quick Release Knots

Everyone knows the simplest way of producing a quick-release knot, slipping the running end back through its last tuck; a few of many varied examples include a Slip Overhand Knot (64), Slip Constrictor Knot (151), Slip Reef (177), Slip Eight Hitch (296), Slippery Hitch (334), Slip Buntline Hitch (345), Slip Sheetbend (423) or Slip Bowline (424). Sometimes the last two tucks are slipped, as in the Slip Anglers Loop (72) and the High Post Hitch (383).

Another interesting set of knots are found in the doubly slipped knots, where one end is slipped in more or less the usual way and the second end is slipped into the first. These include the Donkey Hitch (146), Parcel Knot (182), Shoestring Knot (183), Draw Hitch (384) and Girdle Knot (427).

Toggles can also be used to make quick release knots, where the removal of the toggle spills the knot: the Slip-Toggled Two Loops Knot (166D), Toggled Cow Hitch (381), Twist-Toggled Cow Hitch (382), Slip-Toggled Sheetbend (425). It is interesting to replace some of this kind of toggles with a bight

of the running end, as in the Sheepshank Hitch (363), Release Sheetbend (425C) or Release Bowline (426).

Extra Security

Ways of adding extra security to knots, including securing slip knots, are reviewed for Slip Overhand Knots (65–74), Overhand Nooses (79–81), Reef Knots (168–174), Slip Reef Knots (180–185), Slip Figure Eights (286–287), Slippery Hitches (328C–E), Fishermans Bend (348A–G) and Sheetbends and Bowlines (410–422).

Asher's System

A new way of generating novel bends, and of tying a few well-known ones, has recently been described by Harry Asher. He puts a turn in each end, overlaps or intertwines them in various ways, and then tucks the ends into one of the spaces so formed. I include in this book only a few out of many examples—the Alpine Butterfly Bend (124), the Riggers Bend (128), Carrick Bend (472) and Corrick Bend (480), but I show how extra tucks in the system can generate more complex knots, such as the Double Riggers Bend (129) and the Riggers Eight Bend (308). Some at least of these knots are good bends, and some are quite decorative. Loops can be generated from the bends as previously discussed (for example, the Corrick Loop, 481).

Asher's publications should be examined for further details. He has by no means examined all possible applications of his system, or at any rate he has not published them, so there is scope for a lot more discoveries this way.

FANCY WORK

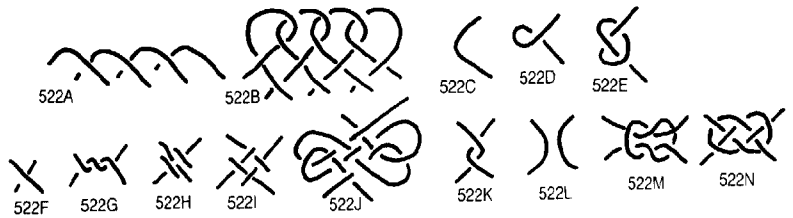
Variations of fancy work are almost infinite, and only a few are given here.

Many of my sections on sennits include suggestions for modification (Overhand Sennits (193–195), square knotting (203), strand knot sennits (234–236) as well as Chapter 21) and I will not further discuss them.

Mats and Flat Knots

The description of Prolonged, Elongated and Augmented Carrick Mats (486–488) shows how simple mats can be enlarged. Similar methods can be applied to other designs.

For more complex designs, it is usually best to work out the design on paper before doing much with rope. Inspiration can be obtained from both celtic and arabic patterns, from basketwork and from various folk designs. Printers also use decorative borders, sometimes quite complex, that can be transferred to ropework. Examples can be found in some books of graphic design; Letraset make some transfers of Decorative Corners (#4118, 4434 5050).



522. Modifications of Flat Knots

Basic designs can be modified; some suggestions are made in 522. Edges (522A) can be made more elaborate (522B); corners (522C) also as in 522D, 522E; crossovers (522F) can be given twists (522G), or crossing knots can be used, such as the Clove Hitch (522H)—see Cavandoli Work (378), or the square knot (322) as in 522I; an example of a much more elaborate crossover is shown in 522J; changes in direction (522K) can be opened out (522L) to outline an inner knot, or replaced by bends such as a Reef Knot (165, 522M) or Carrick Bend (272, 522N,).

Turksheads over Joints

Turksheads can be made over such joints as a T-junction or a cross. Some specific empirical descriptions have been given, but here I give more general guidance. Cut out and paste some paper over the junction, including the arms for the desired length. This mould should be a loose fit, with a clearance of about one cord diameter, and there is no need to try to follow the precise details of the joint much closer than you would expect the cord to go. It may be worth sketching out on the mould the kind of turkshead you expect to make. Then cut the mould open with a minimal number of cuts in the angles and remove the mould. It should be in one piece for a simple T-junction but many other junctions need two pieces. Take care to note the two sides of each cut, so you know where the joins will be. Flatten out the mould by making a minimal number of slits in the angles of the corners. It will probably be worth making several copies of these flattened-out moulds.

Then make grid diagrams, corresponding to those on 490A and the others, taking care that you cross over the joins correctly. Then mark the crossovers, over or under, as in 490B; you should not have any two consecutive crossings the same. In the course of doing this you will find out how many cords you will need; if you are not happy with what you discover, adjust your diagram to have one more or one less bight or part along the arms and try again (this is why you may need copies of the mould, for a bit of trial and error). It is impossible with some configurations to achieve both a single-cord turkshead and a perfectly symmetrical design; you may need to have one of the arms with a different number of bights or parts from the others.

Replace the mould and work the cord along for one pass. Remove the mould and make any additional passes desired.

TYING KNOTS

It is quite likely that the method you used in the first instance to tie the knot you have just developed is not in fact the most efficient way of tying it. When you are working out better ways, it will often pay you to keep an example of the finished knot, or at least a clear open diagram, so that if you get in a muddle you can at least get back to the original knot without relying on your memory alone.

You can often discover ways of tying a knot by untying it carefully, trying a variety of methods. If at any stage of untying there is a loop, can it be withdrawn through the next tuck, or is it blocked? If you pull out a bight for a considerable length, can you pass the knot through the bight and find an easy way of untying? If you give a jerk to any part of the knot, does it capsize, in whole or in part? If you withdraw an end, can you manipulate the remainder into another formation which you may be able to untie easily? If any of these ploys seem to work, you should be able to reverse the moves to get a good way of tying the knot.

Two general principles which may help you have been noted by Harry Asher: if you can untie a loop without using the ends, then the knot can be tied in the bight, without using the ends; if you slide a post out from a hitch round it and the hitch spills completely, then you can tie the knot in the hand without using the ends and slip it over the post. Sometimes it can take a lot of fiddling to find out how to do these things!

Indirect Ways of Tying Knots

I list below a number of knots that can be readily tied by indirect ways, as examples of moves you may need to make with your new discovery.

Starting from a series of turns, overlapped or twisted in various ways, you can get an Anglers Loop (71B), Double Anglers Loop (73B), Tom Fools Knot (97), Handcuff Knot (98), Firemans Chair Knot (99E), Jury Knot (101), Sheepshank (364D), Fishermans Loop (104E), Linesmans Loop (367), Fishermans Eight Loop (303B) or Alpine Butterfly Loop (123F).

Some bends can be tied from a somewhat similar series of turns, such as the Riggers Bend (128E), and others from turns in one rope round the other, such as the Alpine Butterfly Bend (124C), the Weavers Knot (404A), Double Weavers Knot (414) and the Turn-Tucked Sheetbend (418C).

Other loops tied in the bight include the Man Harness Hitch (54C,D) and analogues (55–57), Fishermans Loop (104C), Alpine Butterfly Loop (123B). Loop Handle Knot (167), Snare Noose (292), Figure Eight Double Loop (312), Spanish Bowline (368), Tucked Bowline (420C) and other Bowline derivatives (426, 434, 437A, 443).

Hitches that can be tied in the bight and cast over the spar or whatever include the Constrictor Knot (150F), Hook Hitch (355B), Crossing Knot (318E), Clove Hitch (372D) and Cow Hitch (379E). Hitches that are tied by

starting with the bight round the spar, then cast the bight over the end of the spar include the Overhand Mooring Hitch (142A), Constrictor Knot (150D), Pile Hitch (325), Double Pile Hitch (326), Spar Hitch (462) and Millers Hitch (463).

Capsizing can be used in tying knots, as shown by the Middlemans Loop (105), Mohair Knot (133), Two Half Hitches (161B), Figure Nine Knot (280C–E), Sheetbends and Bowlines started from Overhand Nooses (406–409) and, of course, the Capsized Carrick Bend (477).

Finally, Asher's start for bends is another indirect way of tying a knot, sometimes the most convenient way, already discussed as a way of developing novel bends.

TESTING KNOTS

Having found a knot that looks good, with the highest load on the gentlest curves and with no possibility of capsizing, how do you test it to find out if it is good as it looks?

Tie the knot in a rope of each of natural fibres, a soft synthetic, a hard synthetic, maybe monofilament nylon fishing line, and elastic shock cord. Then jerk the knot in various directions and see if it slips. The shock cord test is particularly interesting, as it seems to detect knots that have only a small tendency to slip in ordinary rope, though interpretation is not always easy. Many knots often considered reasonably secure spill undone after only a few jerks, for example, the Bowline or Sheetbend.

Then put as much load on the knot as you can, with maybe some small jerks, and see if the knot jams, or becomes particularly difficult to untie.

Static kernmantle rope is one of the best to use for serious testing: any knot that is good in kernmantle will be good in just about any other rope, though it may jam. And any knot that jams tight in kernmantle rope will jam in just about any other rope.

What Is a Good Knot?

A good knot:

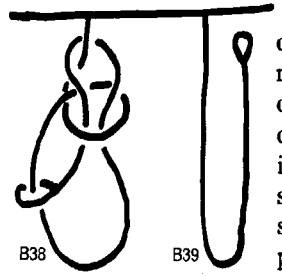
- should be appropriate to the materials used and the task in hand.
- should be easy to tie; if it ever might need to be applied in very awkward circumstances, it helps if it is not too hard to tie one-handed.
- should be easy to work tight, without slack or kinks.
- should be easy to check at a glance that it has been tied correctly; this is most important when you are working with a group of people, any one of whom might need to tie the knot, and much depends on the reliability of the knot.
- should be adequately strong, not weakening the rope unduly, and adequately secure, not unduly likely to slip.
- should be appropriate both to the purpose it is intended to serve and to the rope with which it is to be made.

- should not be liable to come undone by chance, as when subjected to an intermittent load or a give and take motion.
- should be easy to cast off or untie when desired.

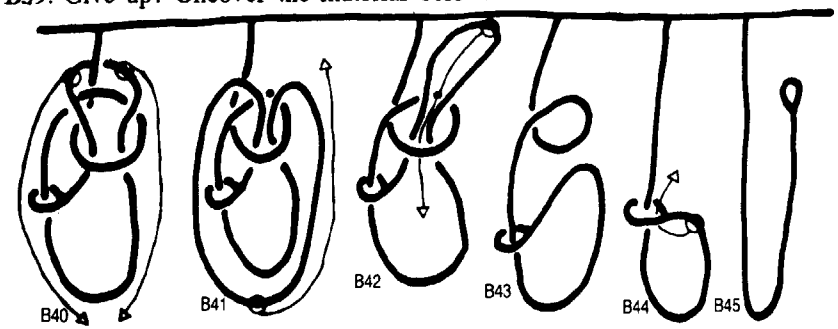
Many of these properties can be screened by methods indicated in the previous section, but before making recommendations for use of a "new" knot, there should be a lot of experience of use of the knot in the application for which it is intended. The strength of a knot really needs to be tested by the proper machinery in laboratory conditions simulating the conditions of application as closely as possible. Thus ropes used for climbing and similar applications are tested by repeated dropping a 80 kg weight from a height of 5 metres. If the rope attached to it can withstand a number of such drops it will successfully hold a falling climber in most circumstances.

ROPE TRICKS

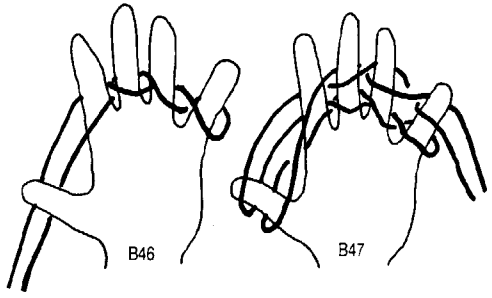
There are many puzzles, conjuring tricks and "magical" turns involving rope and knots. I show a puzzle and a conjuring trick. The first involves several manipulations useful for those learning to develop their own knots.



If you would like to test your own skill, cover over the diagrams B40–B45 and the text below, then read on. You have a rope with a permananent eye on one end and the other end fixed permanently to some object (B39). The problem is, without removing or interfering with either the eye or the fixture, either to start with B38 and untie the knot to give B39, or to start with B39 and make B38. It is easier for most people to start by untying the knot, but that means that someone else has to tie it, or else make the eye after making the knot. After untying the knot, then re-tie it. Or start by trying to tie the knot, from B39. Give up? Uncover the material below.



To untie B38, lift up the loop of the Bowline (B40) and draw it below the main loop (B41) then up again in front of the knot (B42). Withdraw the bight through the turn (B43), spill the turn (B44), and invert the loop as in 35A–35C (B45). Simply reverse these moves to re-tie the knot.



The second rope trick is for a performer in front of an audience. The performer must remember the exact method of weaving the cord round the fingers, (B46–B47). When finished, after suitable patter, withdraw the thumbs and give the cord a strong tug. If you have done the right thing, you will not cut your fingers off but have a free cord.

PART FIVE

FIELD ENGINEERING

In this highly mechanised age it is often forgotten what a lot of field construction can be achieved with little equipment. Many things that now would be called mere shifts and expedients used to be standard techniques. Some of these practices are not exactly knotting, though they do involve the use of some knots and are certainly ropework. They are often used in connection with activities that make considerable use of the knots that have been discussed above. They need little more than rope, spars, pickets and a knowledge of how to use them.

Chapter 23
SURVEYING OR PRACTICAL GEOMETRY

These are the methods used in the building of the pyramids and a whole lot else until little more than a couple of centuries ago, when instruments like theodolites and dumpy levels began to come into common use. They are still useful even for such things as laying out a house or a small bridge.

Your layout constructions, as described below, should be scaled to a significant proportion of the job you are working on. If, say, you wish to construct something 10 m square, it would be absurd to make your right angle construction (523 or 524) on lengths of, say, 20 cm—they should be on a scale of 2 or 3 m, preferably more. That is why it is impractical without high skill, experience and specially made equipment to get acceptable accuracy for many purposes for constructions much larger than a domestic scale, with heights and distances around 10–30 m or so.

Equipment

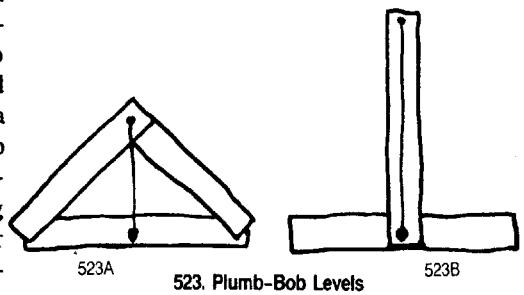
A suitable length of light chain would be ideal for laying out precise lines, but otherwise choose a flexible cord with minimal stretch, perhaps around 5 mm diameter, commonly called a **measuring cord** and try to place an equal and constant strain on it whenever you want it straight. You will need some small pegs, perhaps 25–30 cm long, preferably made of metal as long as you are not using a compass near iron; and you will want a hammer or something to drive then firmly into the ground.

If you are measuring distances or heights, you will need something to measure with; a measuring tape will do for some things, but more generally useful is a measuring rod, about 2–3 m long, graduated in cm.

If you are measuring heights or levels, you will need some sort of levelling instrument. Probably the best is an ordinary spirit level, together with some sort of sighting vane. The simplest vane is a wooden rod, even an ordinary ruler, straight and about the length of the spirit level, with small flat-headed nails or pins at each end, carefully placed to have the heads the same height above the rod. In use, you sight along the heads of the pins. A better device is a metal tube around 1 cm diameter, about as long as the level and with some sort of fixing to keep it firm and flat on the level; rubber bands may be used but a fixed metal plate is better. One end is blocked off except for a small hole in the centre, and the other end has a wire or a small strip of

sheet metal fixed horizontally and centrally. Sight through the hole across the horizontal wire or strip; you may need to check a newly made vane that in fact this line is parallel with the base. Mostly you will be wanting to know the height of something above ground level. It is inconvenient to place the level into the ground and try to sight along it, so prop the level on two pickets, carefully driven in the ground until they are firm and level. You will need to measure the height of the level, or rather the sighting vane and use this to adjust your calculated heights.

In the absence of a spirit level, there are several possibilities. One is the **Plumb-Bob Level (523)**. Construct a rigid frame that will suspend a plumb-bob a metre or two above a flat plank or bar suitable for holding your sighting vane. The frame could be either a triangle (523A) or like a T-square (523B). The frame does not need to be accurately made if you can calibrate it on a known level line: mark where the plumb-bob comes when the lower leg is level. Otherwise an accurate isoscelese triangle or an accurate right-angled T-square needs to be made and the position for the mark carefully calculated. For another way of levelling you can use a length of clear plastic tubing nearly full of water, with each end firmly lashed to a vertical picket; sight along the water line. If all the points to be levelled are within reach of a long length of tubing (up to 30 metres have been used) you can fill it with water; the tubing must be free of air bubbles, so clear plastic tubing is best. Lay out this tube between two points you wish to get level and take the meniscus of the water in the tube at each end as being level. Failing any of these expedients, much can be done with a basin of muddy water, or even a puddle in the ground if it is in the right place, as described below.

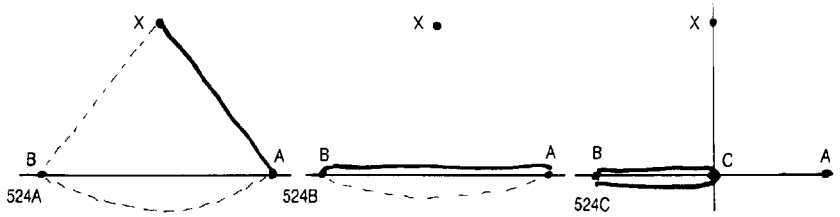


523. Plumb-Bob Levels

You will need to get your measuring rod vertical: suspend it loosely in the fingers near the top, and carefully lower it on to the desired point. If the surroundings make it difficult to tell verticality by eye, use a plumb-bob—a weight such as a small stone suspended on a piece of twine.

MAKING ANGLES

Right Angle from a Point (524). Given a line, marked by a long cord fastened at each end to pegs, and a point X away from it, marked by another peg, you want to drop a line from X at right angles to the original line.

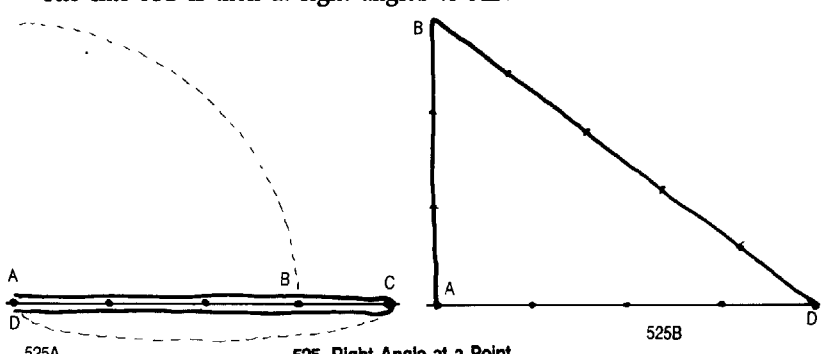


524. Right Angle from a Point

Attach one end of a measuring cord at point X. Choose a point A on the line so that the cord XA makes an angle of approximately 60° with the line, as judged by eye. Mark point A with a peg in the ground and hold the cord at that point while you move the cord to point B on the line where the place you are holding on the cord meets the line again. Drive in a peg at B (524B). Then XA=XB.

Find the mid-point C of the line AB by taking a measuring cord, fastened at point B, to point A. Hold the cord at that place and take it back to B. When the cord is taut again, the point C where the doubled cord ends on the line is the mid-point (524C).

The line XC is then at right angles to AB.



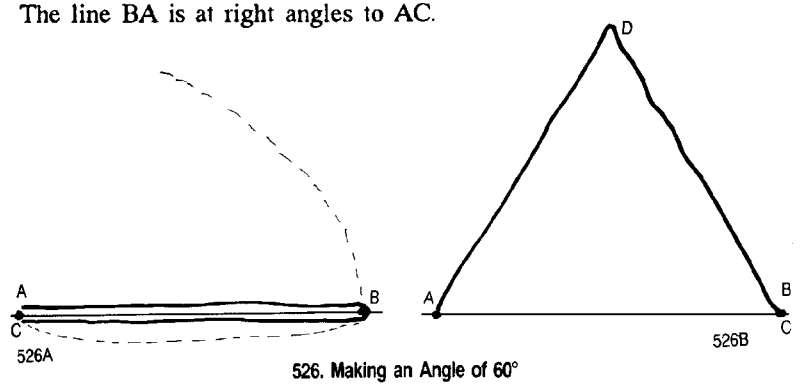
525. Right Angle at a Point

Right Angle at a Point (525). Given a line marked by a cord between two pegs and a point A, marked by a peg, on the line, you want to make a line from A at right angles to the original line.

Along the line from A mark out four equal distances; these distances do not need to be known in metres, but should be carefully equal. Mark the third point B and the fourth point C with pegs (525A). Then take your cord from A to C and back again to A, calling this end of the cord D. Keep hold of the

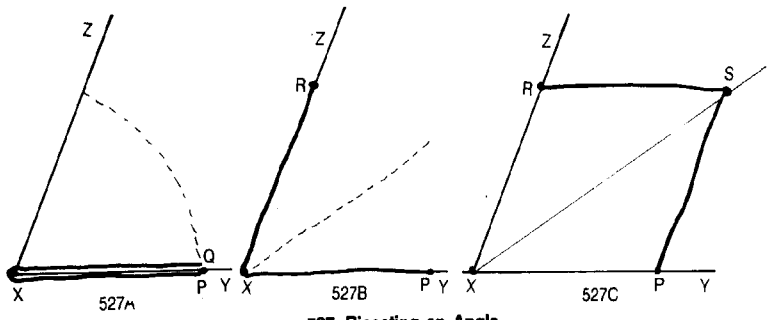
cord at A, B and D. Slack off and move the cord so that B moves in the direction where you want your line and D moves to C. When the cord is tight, mark where the point B has reached with a peg (525B).

The line BA is at right angles to AC.



526. Making an Angle of 60°

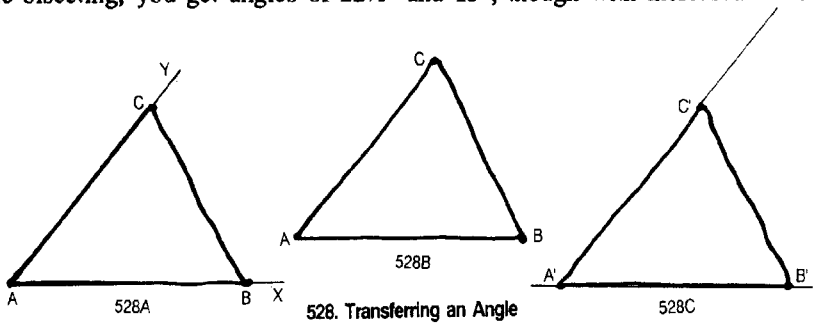
Making an Angle of 60° (526). Angles of 60° are mainly wanted for erecting tripods. Place two pegs A, B along the base line a suitable distance apart (measurement is not needed). Take a measuring cord from A to B and back again to A, calling that point on the cord C (526). Hold the cord at A, B and C; move the end C to the original point B, and the place on the cord that was at B away from the line until the cord is tight; mark this point, D, with a peg (526B). Then the triangle ABD is equilateral and all three angles at the corners are 60°.



527. Bisecting an Angle

Bisecting an Angle (527). There is often a need to have a line half way between two others, that is, to bisect the angle, maybe to distribute a load evenly. You have two lines XY, XZ, intersecting at X. Place a peg at X and another at P, a suitable distance away (measurement not needed). Take a cord from P to X and back to P, calling that point on the cord Q (527A). Hold the cord at P, Q and X and move the end Q until it lies tight along the line XZ; mark that point, R, with a peg (527B). Hold the cord steady at R and P and move the cord that was at X between the two lines until the cord is tight again,

then place a peg S at the point on the cord that had been at X (527C). Then the line XS bisects the angle YXZ. Since 524, 525 and 526 have given you angles of 90° and 60°, you can now form angles of 45° and 30°. If you repeat the bisecting, you get angles of 22½° and 15°, though with increased error.



528. Transferring an Angle

Transferring an Angle (528). You have two lines, XA and YA meeting at A forming an angle XAY that you wish to duplicate somewhere else, perhaps to produce a parallel line. Take a measuring cord, hold the two ends at A and form a triangle ABC with B along AX and C along AY (528A); it is best to have AB and AC roughly equal. Hold the cord at points A, B and C and pick it up (528B) and move it to the line where you want the duplicated angle, placing A at a peg where you want the apex of the new angle (call it A') and, with the cord tight, AB along the line to a point, call it B'. Where the point C on the tight cord falls, drive in a peg, call it C'. Then the angle B'A'C' is equal to the original angle XAY.

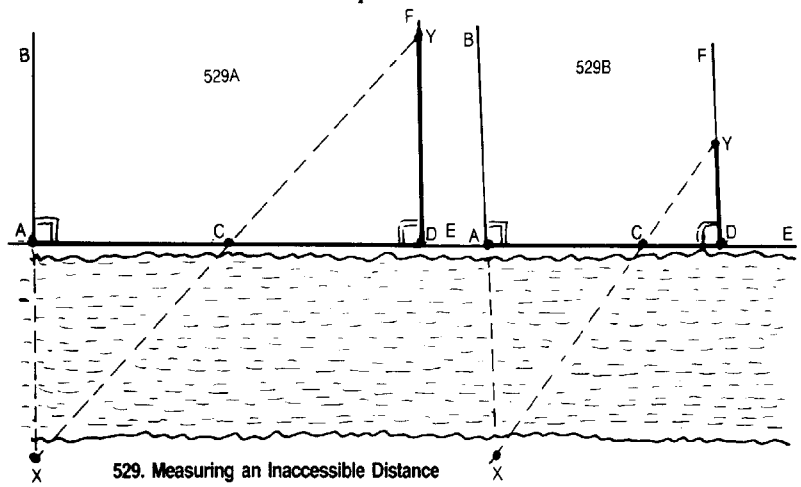
MEASURING INACCESSIBLE DISTANCES AND HEIGHTS

Inaccessible Distances (529). It is nearly always possible to measure the distance across a creek or gully by fastening one end of a measuring cord on one side and, holding the other end, swim across the creek or scramble across the gully, mark the cord at the desired point on the far side, struggle back with the marked cord and measure its length. However, this is sometimes inconvenient and an indirect method is needed.

You have a point A, marked with a peg, on the near side of the obstruction, and an inaccessible point X on the far side, so that you wish to determine the distance AX. Walk back from the obstruction keeping A and X in line for a suitable distance and drive in a peg B such that B, A and X are in one straight line (529A,B,C). What you do next depends on the space available and, to some extent, on the accuracy desired.

With ample space, and for maximum accuracy, lay out a line AE at right angles to AB at A (as in 525). Along this line place a peg at C (529A), where you guess that AC is roughly equal to the unknown distance AX. You will probably need to have a vertical stick about 2 m long at point C. Hold a

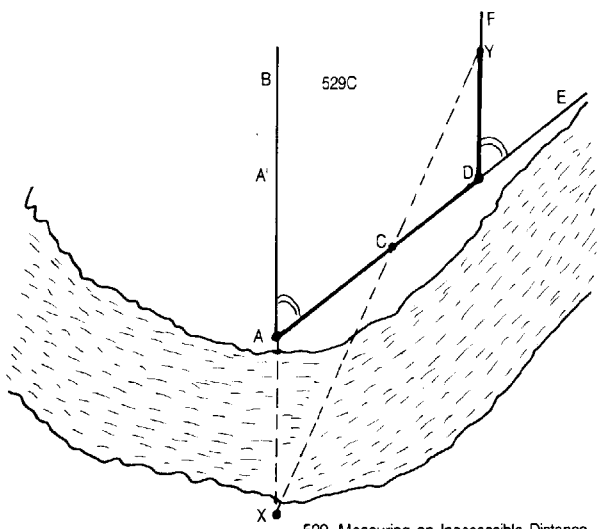
measuring cord tight between A and C and then, keeping hold of the points on the cord where the pegs were, move along the line AE and place a peg at D, such that AC=CD. Construct another right angle at D, laying out a line DF with cord. Walk along the line DF until you find a point Y on it such that Y, C and X are in line (it helps to hold a vertical stick, about 2 m long above the line DF and sight past it). Mark this point with a peg and measure the distance DY. This distance DY is then equal to the distance AX.



529. Measuring an Inaccessible Distance

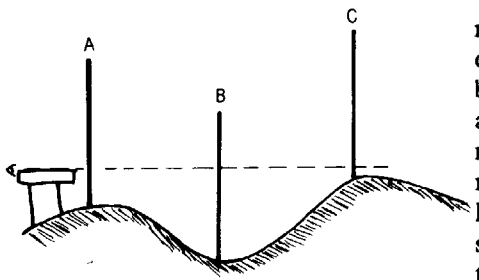
If space is more limited or the full-scale layout of 529A is inconvenient and you do not mind some loss of accuracy, you can follow the similar layout of 529B. This is the same as 529A, except that AC can be a bit less than AX and CD can be a fair bit less than AC. You will need to measure AC, CD and DY. AX = (DY×AC)/CD.

If space does not allow AE to be at right angles to AB (529C), you can either go back along the line AB and mark a point A' such that you can use the layout of 529A or 529B to calculate the distance A'X, and then subtract the distance AA'. Or you can place your



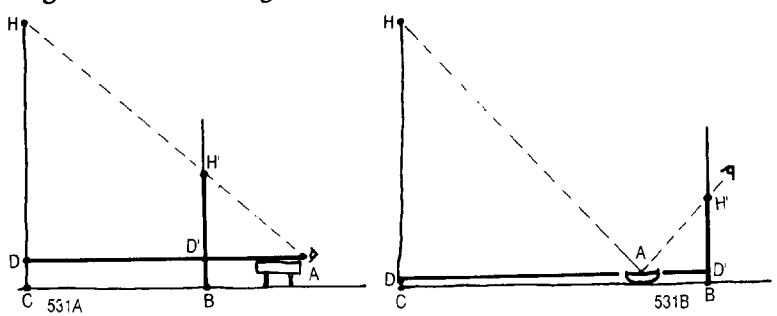
529. Measuring an Inaccessible Distance

line AE at a smaller angle to AB (529C). Mark out on this line points C and D as in 529A or 529B. Then transfer the angle BAE to the point D (as in 528) so that the angle FDE equals BAE. As before, find and mark the point Y on DF such that X, C and Y are in line. Then AX = (DY×AC)/CD. It may be possible to combine these two methods so that the angle BA'E is as close to a right angle as possible and AA' as short as possible.



530. Levelling

Levelling (530). If you want to make some uneven ground level, or if you want to place a level bridge (or one with known camber) above uneven ground with intermediate supports, you will need to measure the height of a level air line above the ground. Set up your spirit level or levelling tube above the highest point you wish to measure (530). Hold a vertical measuring rod above the points you wish to measure and mark the point where the level air line (which you sight along the level) meets the rod. Measure this distance to the end of the rod; this is the height of the air line above the ground. If you want the vertical distance of your point below some other point, say A on 530, then measure the height above A of the air line. If you want A, B and C at fixed distances apart, it is best to use a taut line from A to C, already marked at the correct distances, and find point B by either using a vertical measuring rod or dropping a small stone from the mark on the line and noticing where it hits the ground.



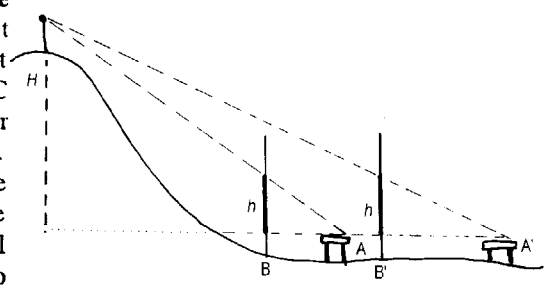
531. Measuring an Inaccessible Height, with an Accessible Base

Inaccessible Height, Accessible Base (531). Set up your level (531A) at a point A at a distance AC from the base C preferably roughly equal to the height CH. Mark where the level air line meets the vertical object at D. Place a vertical measuring rod at B as close to C as convenient and mark on it the point D' where the level air line meets it. From the end of the level, sight to the top H and mark H' on the measuring rod where the sight line meets it.

Measure AB, AC, CD and D'H'. Then the height CH = [(D'H'×AC)/AB]+CD.

If you have no spirit level or levelling tube, it is possible in a good light to use a basin of muddy water or even a puddle. For accuracy the basin needs to be as small as possible, but to locate what you are looking for in the reflections in the water the basin needs to be large; maybe the best compromise is to have a large basin with a small object such as a cup inside it, the water level being below the rim of the cup. Place the basin on the ground at a point A at a distance from C roughly equal to the height CH. Place a vertical measuring rod at a point B as far back from the basin as convenient (531B). Keeping your eye close to the rod, sight the reflection of the point H in the basin, or the small cup inside it, and mark the point H' on the rod where you are sighting from. Mark on the rod a point D' equal to the height of the top of the water in the basin (maybe dip the rod in the basin) and assume a point D' on CH at the same height (CD=BD'). Then CH = [(D'H'×AC)/AB]+CD. This assumes that the ground is level between A and B.

Totally Inaccessible Height (532). If you can't get to the base of the object to measure the distance AC in 531, you need rather more complex calculations. These calculations involve the use of the difference between two fairly small figures, so you will need to make your measurements as accurately as possible for anything like accurate results.



532. Measuring a Totally Inaccessible Height

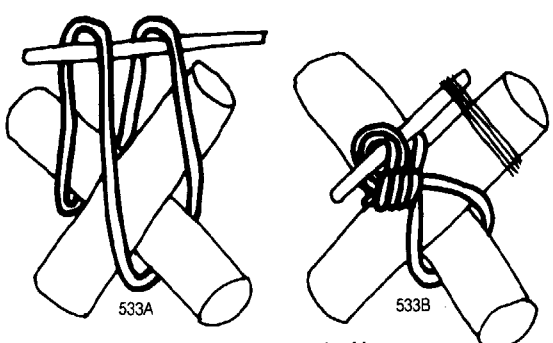
First set up your level at point A, preferably at a distance a bit closer to the base than the height. As before, set up a measuring rod at B as close to the base as convenient and mark on it where the level air line and the sight line to the top meet it. The distance between these two points is measured as *h*. Keep the measuring rod where it is and move the level a fair way back to A', at a distance from the base greater than the height. Adjust the level so that the level air line meets the measuring rod at the same point as before. Then move the measuring rod back to a point B' such that the sight line to the top and the level air line cut the rod at exactly the same points as before. Measure AB, A'B', AA'. Then the unknown height $H = (h \times AA')/(A'B'-AB)$ plus the height of the level.

Chapter 24
LASHINGS

Lashings use rope to fasten two or more spars together to take some kind of load. It helps to avoid slipping if both the rope and the spars have rough surfaces, but the main factor is the tightness of the lashing. For maximum security, each turn of the lashing should be tightened with a pull getting close to the safe working load of the rope. A fit man can reasonably pull about 50 kg under these conditions, using a spar for a lever in the rope, so for, say, 12 mm natural fibre rope at least two men are needed to tighten each turn. The tension in the rope must, of course, be maintained while making the next turn. To give efficient tightening, the turns must be close together (knock them together with a wooden mallet), arranged to follow as straight a lead as possible between spars, with no riding turns. The starting and finishing knots must be worked to take direct pulls to the lashing, with no possibility of rotating or moving on the spar under load.

Given all this, the exact method of placing the ropes in the lashing is relatively unimportant. Once the lashing is tight enough to prevent slipping, its safe working load can be calculated as the sum of the safe working loads of all the returns less about 20–30% to allow for the relatively sharp curves in the lashing. However, for many purposes there is no need to go for maximum strength or security and so no need to go to so much trouble to make the lashing really tight; but remember always that tightness makes for reliability.

TEMPORARY OR EMERGENCY LASHINGS



533. Tourniquet Lashing

Attention is called to two knots described previously, the Cobb & Co Hitch (44) and the Transom Knot (160) that can be used as temporary or emergency lashings in many situations. Another is the **Tourniquet Lashing (533)**. You need a sling of rope up to about a quarter of the average diameter of the spars.

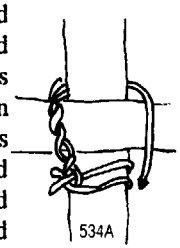
If the ends of the spars are unavailable, the sling should be formed around the spars (533A) by joining the ends of a suitable rope. Any knots should be below the spars out of the way. Place the sling round the spars as shown (533A) and insert a strong lever. Tighten the tourniquet by twisting and fasten the lever to a convenient spar (533B). The tight twists weaken the rope and the leverage used is such as to be liable to make the rope unfit for further use or even to break it if you are not careful.

SQUARE LASHINGS

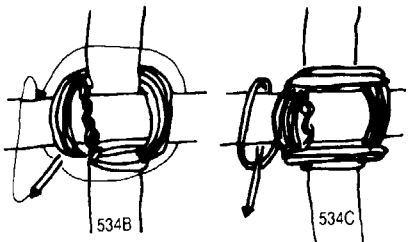
Square lashings are used when the load tends to push one spar along the other; usually, there is a horizontal load-bearing spar supported on an upright, but this not the only application, and it is not even necessary for the spars to be at right angles. Normally, of course, the lashing is tied with the construction lying on the ground.

The **Square Lashing (534)** needs for best results a rope of diameter about a tenth of the average diameter of the two spars and of a length about 75 times that average spar diameter. Start it by tying a Clove Hitch (372) below the load (534A). In the common case of a horizontal load-bearing spar on an upright, this means that the Clove Hitch is on the upright below the horizontal spar. The Clove Hitch should be worked as tight as possible and arranged so that the lead from the centre of the knot is directly in line with the first turn, so that pulling the turns tight cannot rotate the Clove Hitch on the spar. If the load-bearing spar is sloping, you should make your first turn on the uphill side; if not, on the side that will be most out of the way in the finished lashing; all this is because you finish the lashing on the same side you start it, and those are the best finishing points. The running end from the Clove Hitch is twisted with the standing part (with the lay of the rope if it is laid) a sufficient distance to pass over the next spar; this holds the end tight without the bulk of Half Hitches or the trouble of a seizing. If you know that your rope is a bit short for the job, it is best to save a bit of rope by starting instead with a Timber Hitch (300), again with the pull direct off the knot, thus allowing the maximum number of turns.

Take the rope up and over the horizontal spar, round behind the upright, back over the horizontal spar (534A) and then behind the upright again, inside the Clove Hitch. This completes one turn, and it should be pulled tight and held in position while the next turn is being made. Subsequent turns should pass outside the previous turns on the horizontal, and inside on the vertical spar to allow the most direct pull, and should be close beside the previous turns, with no gap and no riding. Each turn should be pulled tight on completion and held tight until the next turn is completed.



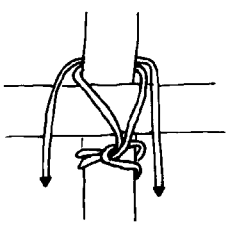
534. Square Lashing



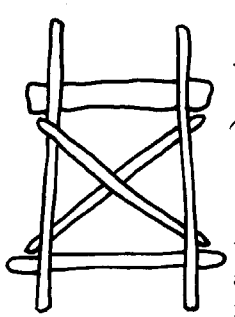
534. Square Lashing

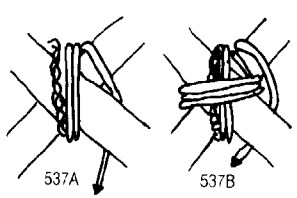
Make four complete turns (534B), then lead the running end round the horizontal spar to give a direct start to the frapping turns between the two spars. Two frapping turns should be made, pulling each very tight on completion. Make a Half Hitch on the horizontal spar in the direction that gives a direct pull (534C) and work tight and hard up against the frapping turn, then make a second Half Hitch tight and hard up against the first. You may need more Half Hitches if you are using slippery synthetic rope. Any surplus rope should be wrapped tightly round the spar and secured with one or two Half Hitches. If your rope is the correct diameter for the job there will be little space in the middle of the lashing on the vertical spar, and the frapping turns will just about fill the space available.

The **Quick Square Lashing (535)** is used for lighter loads since it cannot be pulled as tight as 534 but, after a little practice, it is a lot quicker to make. Start with a Cow Hitch (379) in the middle of the rope below the load. Separate the two ends and take them in the Square Lashing turns in opposite directions, avoiding riding turns as much as possible. Complete four turns (two in each direction), make two frapping turns also in opposite directions and finish by tying a Reef Knot (165) over the frapping turns.


535. Quick Square Lashing

DIAGONAL LASHING


536. Square Trestle

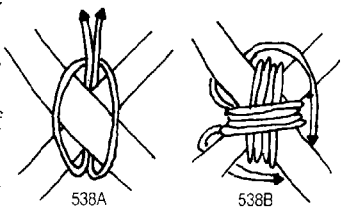


537. Diagonal Lashing

Strictly, a **Diagonal Lashing (537)** should only be used in the centre of a **Square Trestle (536)** where it stabilises the trestle by preventing rotation of the horizontal spars in opposite directions about a vertical axis; that is, the two diagonal braces have a tendency to spring apart. However, it is easier to make than a Square Lashing (534) when the spars are a long way from perpendicular, so the Diagonal Lashing is sometimes used instead, though it is neither as strong nor as secure.

Start with a Timber Hitch (300) round the vertical crutch (537A); you may need to force the two spars together. Complete three turns round the vertical crutch, counting the Timber Hitch as one, pulling each turn tight in turn. Change direction to give a direct lead to the horizontal crutch, complete three turns (537B), then two frapping turns. Finish with two Half Hitches on an uphill spar, worked tight as before (534).

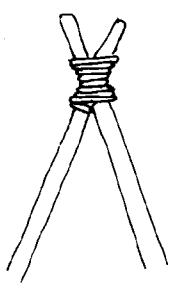
A Quick Diagonal Lashing (538) can be used whenever the spars will be only lightly loaded, specially when they meet at angles that make a Square Lashing inconvenient. Start with a Cow Hitch (379) in the middle of the rope round the vertical crutch (538A). Complete two turns with the doubled rope round the vertical crutch, counting the Cow Hitch as one, then two turns round the horizontal crutch. Separate the two ropes and make two frapping turns in opposite direction, finishing by joining the two ends with a Reef Knot (165) over the frapping turns.



538. Quick Diagonal Lashing

OTHER LASHINGS

The **Shear Lashing (539)** is used to join the legs of a shearlegs for lifting weights. Start with the legs parallel and close together. If the legs are to be splayed 1:5, which is the most efficient, chock the legs apart at a distance a trifle greater than the rope diameter. The legs have to be opened up, straining the lashing, so it should not be pulled tight. It is impossible to tie the turns uniformly loose, so the legs are chocked and the turns made uniformly tight, giving the right degree of looseness when the chocks are removed.

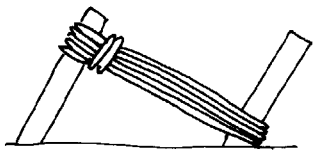

539. Shear Lashing

Start with a Clove Hitch on one spar at the bottom of the lashing, with the running end twisted with the standing part as in 534; take eight turns round the two spars, pulling each tight, then make two frapping turns and finish with two Half Hitches, worked tight as in 534, on either spar above the lashing.

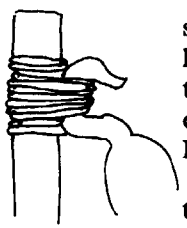
The **Round Lashing (540)** is used to join two spars end to end, or fasten on a strengthening spar or "fish". It is better to have two lashings at the two ends of the join rather than one long lashing. Start with a Clove Hitch as in 534 on the lower spar (start both lashings before you take any turns). Take as many turns as the rope will allow round both spars, and finish with two Half Hitches worked tight round both spars. Since there is no space for frapping turns, tighten by driving round wooden wedges between the two spars and the rope.

540. Round Lashing

The **Holdfast Lashing (541)** is used to lash two pickets in series to take a greater load than a single one could stand; this is particularly useful in soft ground. The front picket should be driven in so that the picket will be at right angles to the load. The rear picket should be driven in parallel to the

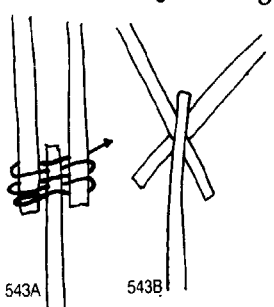

541. Holdfast Lashing

first at a point where the lashing between them will be at right angles to the pickets. Start with a Clove Hitch round the front picket, below the lashing. Secure the running end with two Half Hitches. Take as many turns as the rope allows from the top of the front picket to the bottom of the rear one. Finish with two Half Hitches tied as frapping turns round all returns, hard up to the front picket.


542. Block Lashing

A **Block Lashing (542)** secures the hook of a block to a spar. Start with a Clove Hitch on the spar at the back of the hook, with the ends twisted as in 534. Make as many tight turns round spar and hook as you can readily fit in the mouth of the hook, riding turns as necessary, and finish with two Half Hitches drawn tight round the spar above the hook.

A **Figure Eight Lashing (543)** is used at the peak of a tripod. It is possible to make something similar to a Shear Lashing (539) round all three spars, but it is not very secure. It is best to arrange the three spars as in 543A, chocked a distance apart a trifle less than the spar diameters, to allow for a final splay of 1:3. Start with a Clove Hitch round an outside spar, with the ends twisted as in 534. Take turns round the three spars in a figure eight pattern, keeping the turns tight and close. Then make two frapping turns between each pair of spars and finish with two Half Hitches at the top of the outside spar you did not start on. Cross the two outside spars below the middle one (543B) and erect the tripod.



543. Figure Eight Lashing

544. Snake Lashing

A **Snake Lashing (544)** holds a series of horizontal spars or slats on bearers, as a roadway on a bridge or a tabletop; there will normally be a bearer at each end of the spars, and perhaps some intermediate ones. Start with a Clove Hitch secured with two Half Hitches round a bearer and lead the rope over a spar, under the bearer and up the other side, over the next spar, under the bearer and so on. Finish with two Half Hitches drawn tight on the bearer at the other end. For greater security, repeat, taking the turns round the bearer in the opposite direction, so that you have the two ropes crossed on the top.

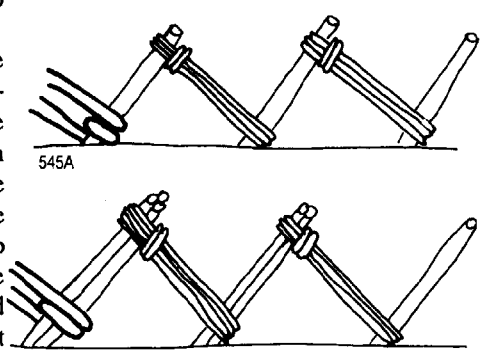
Chapter 25
ANCHORAGES

You need an anchorage for many constructions to take a pull or to which to fasten something. Likewise you need anchorages to debog a car, to descend a cliff on a rope, or to beach a boat. I discuss a few artificial and a few natural anchorages. If you think you may be working close to the limits of the rope, you can minimise the weakening effect of knots by using **tensionless rigging**. Take your rope a number of times round the anchorage, the wider and the rougher the anchorage the fewer turns are needed, so that the friction round the anchorage holds the load. Secure the end either to the anchorage or something else nearby, or attach to the standing part with a loose loop such as a Bowline, or use a karabiner. There is virtually no load on this knot, so it will not weaken the main rope.

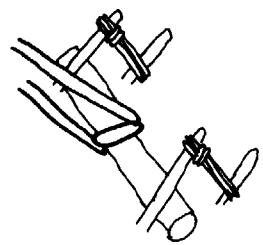
ARTIFICIAL ANCHORAGES

If you have strong pickets, you can make a **Picket Anchorage (545)**. Good practical pickets are up to about 1.5 m long, and up to about 10 cm in diameter; it is desirable to bind the top of the picket with a metal strap, wire or even rope to prevent splitting when driving in with a sledge hammer or maul. These can be driven about 1 m into the ground if it is suitable. Pickets should be driven in so that the pull is taken close to the ground and the picket is approximately at right angles to the pull; if the angle of pull varies, make sure it can never cause the rope to slide off the top of the picket.

Except for light loads, a single picket is seldom sufficiently secure. You can place two or three in line with the pull, linked with Holdfast Lashings (541), with the lashings at right angles to the pickets and running from the top of the foremost picket to the base of the next (545A). A greater load can be taken by replacing the first picket by three driven in close



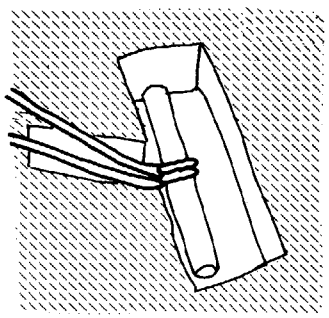
545. Picket Anchorage



546. Log and Picket Anchorage

together, and the second by two (545B); it may be difficult to get all pickets parallel if there are many stones in the ground.

Somewhat more secure is a **Log and Picket Anchorage (546)**. A heavy log forms the anchorage, held in place by a number of pickets in front lashed to pickets behind. I show only two pairs of pickets; in most conditions more might be desirable: in soft ground that does not hold well, three or more on each side could be used.



547. Deadman Anchorage

The most secure anchorage of this kind, applicable even to loose sandy soil, is the **Deadman Anchorage (547)**. Dig a trench at right angles to the pull, and from its middle dig a trench in line with the pull, sloping up. The depth of these trenches depends on the softness of the soil and the load to be pulled; do not make them too shallow. Place a log in the trench and make fast your rope to it, leading up the side trench. In very firm soil, there may be no need to bury all this if you undercut the side of the main trench, but in more sandy soil you should bury the lot. If you have no big log, many things could be substituted, though I have no experience of an actual dead man. For debogging cars, the spare wheel can often be used.

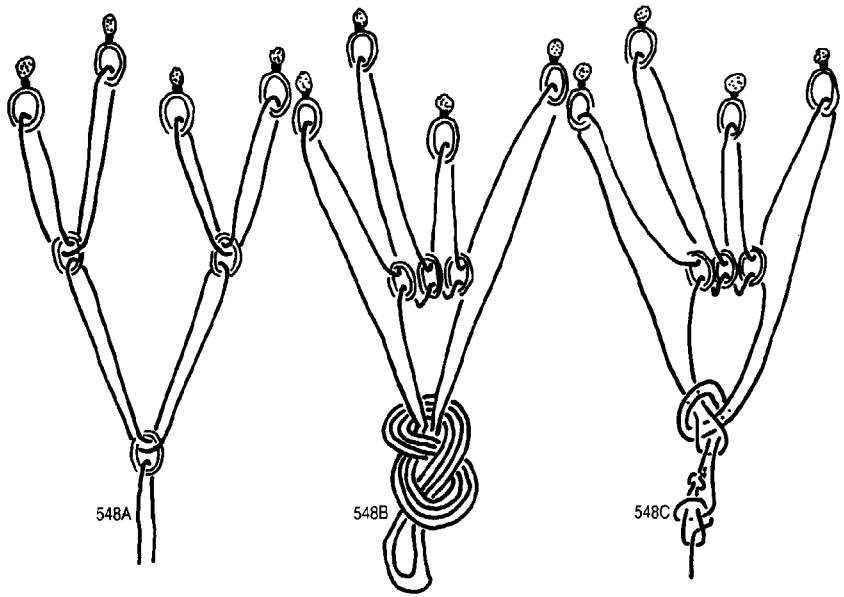
NATURAL ANCHORAGES

Trees provide excellent strong, secure anchorages if they do not have shallow roots such as are found when there is only a shallow layer of soil overlying rock. Ropes should be made fast near the base if there is any doubt about the holding power. If possible, choose a tree as near to at right angles to the pull as you can get; if none seem suitable, place some kind of collar round the tree where it will prevent slippage of the rope. The bark of living trees should be protected by sacking or the like: this also protects the rope from entry of bark fibres.

Boulders of suitable size and consistency are also good. If they are not well embedded in the ground, they should be quite a number of times heavier than the load.

If you are not quite confident of the holding power of your anchorage and there is another, maybe also a bit weak, in line with your load that you can use as a backup, link the two with something analogous to the Holdfast Lashing (541), which should be tight.

If all your available anchorages are a little doubtful, and they are not in



548. Self-Equalising Anchorages

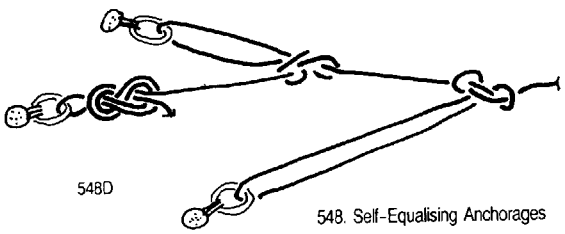
line with your load, you can still safeguard yourself by linking a number of weak anchor points in a **Self-Equalising Anchorage (548)**. These automatically equalise the load over all the anchor points, even if the main pull changes direction a bit. Even if one anchor pulls out altogether, the load is still spread evenly over the remainder. All are intended for use with karabiners or other links, preferably of metal.

A number of relatively small slings is used in 548A. The legs of the slings cross in the karabiner, to prevent loss of more than one anchor point if one fails. If you are using non-opening links you will have to tie the sling into the link, but if you have an opening link such as a karabiner, form your sling in a figure eight and snap the link round the crossover. Anchor points are linked in pairs, but if you have an odd number of anchor points, make the single link to the strongest.

A much larger sling is used in 548B. Double the sling and make a Figure Eight Knot (279) with unequal bights at one end, using the quadruple rope. The longer bight links all the anchor points to the shorter one.

A similar linkage is used in 548C, using no slings, only the main rope. Make a Bowline on the Bight (437) with very unequal legs; join the running end with the standing part with a secured (as in 410) Bowline (400).

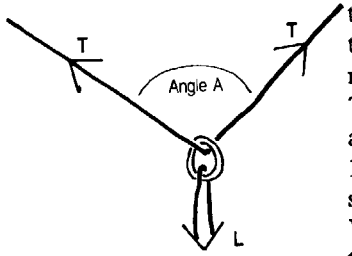
A somewhat different method (548D) is often quicker to set up, but is not nearly so adaptable to a change in direction of the load.



548. Self-Equalising Anchorages

Make your rope fast to the furthest anchor point with a Figure Eight Loop (309) in the end of the rope, and to the other anchor points with an Alpine Butterfly Loop (123), arranged so that the main rope remains more or less straight.

If your weak anchor points are well spread out sideways, you must make your linkages sufficiently long to allow for the **resultant forces** at various angles (549). If a load L is shared between two legs of a rope forming an angle A, then the load T in the legs is not far from approximately ½L if the angle A is less than about 75°, but then increases rapidly with increasing angle, so that it is ¾L at 90°, L at 120°, 2L at 150°, 4L at 165° and 12L at 175° (this assumes that the legs are straight, with no sag). You should therefore never exceed 120° between legs of a self-equalising anchor.



549. Resultant Forces

You might like to note that these same figures apply to the relation between the weight of a person crossing a simple rope bridge and the loading in the rope. That is why such rope bridges must sag quite a bit, or else have very strong rope.

Chapter 26
TACKLES

There are many devices to magnify an effort. Tackles make it possible to lift heavy loads with small effort—but of course the small effort must be exerted for a longer time or over a longer distance. Tackles have other advantages: they make control of the exact position and motion much easier, both because the motion of the load is less than that of the running end and because of internal friction in the system, which also makes holding a load or lowering it much easier. In this chapter I emphasise techniques that need minimal equipment.

People sometimes underestimate the effects of friction. They calculate the

"mechanical advantage" using the most simplified elementary physical principles and fail to realise that internal friction can nullify a large part, or even all, of that advantage. The friction comes from two main causes: the friction between the rope and the pulleys wheels or **sheaves**, including the friction of the bearings, or if you are using non-moving "sheaves", that between the rope and whatever you are using instead; and the friction due to the rapid transfer of the sharp 180° bend along the length of the rope, moving all the fibres relative to each other as well as differentially stretching them. Proper pulley blocks for tackles minimise these effects by having the diameter of the sheaves between 5 and 10 times the diameter of the rope to be used, depending on the kind of rope, and also efficient bearings. This makes the blocks bulky and heavy, so in several applications smaller blocks, with sheaves only about twice the diameter of the rope, have come into use; kernmantle rope is less affected by these small sheaves.

The friction due to the large sheaves is usually between 5% and 10% per sheave: that is, to calculate the pull needed to move a given load, use a load figure increased by a factor equal to the total number of sheaves in the system multiplied by between 5% and 10% of the load; it is this figure that you divide by the theoretical mechanical advantage. The friction due to the small sheaves is usually between 10% and 20%. If you use a round metal rod (such as a truck loading rail or a karabiner) or a smooth wooden rod (such as a post or a tree), you need something more like 50% for friction, while if you try for a wholly rope tackle, with the rope fall running through a rope loop, friction can add 100% or even more of the load, so that many tackle systems, excellent with low-friction sheaves, give no practical advantage, and it may even be much easier to pull direct than use the tackle, though the other advantages of the tackle may remain.

This may be tested quite easily. Rig your block or substitute, pass a rope through or over it. On one side have a known weight (which should be a substantial fraction of the safe working load of the rope) and on the other a suitable spring balance (550). This sort of arrangement, without the balance, has been called a **runner block**; it changes the direction of the pull without any mechanical advantage. Pull on the balance to raise the weight and record the reading; the excess of pull over the load is due to friction. Note that wholly rope tackles suffer a lot from friction, which is turned into heat. If the rope is synthetic, it is very easy to melt through the rope at the loop. If you have nothing else to use as a "sheave", be extremely careful. Expedients that have been suggested to minimise this effect include the use of a small sling of much heavier rope, hoping that it will last longer, or the use of a suitably sized stick. as "sheave".

550. Measuring Friction: Runner

Tackles can be rigged in two ways, which I call the **lifting** mode, when the direction of pull is opposite to the direction of movement of the load, and the **towing** mode, when they are the same. The lifting mode is typically used

when you pull down to raise the load; the towing mode is often used when you are pulling a horizontal load, or wish to tighten a rope over something, but is also used to lift a load from above. The towing mode has a theoretical mechanical advantage of one more than the same system in the lifting mode. The simplest tackle, using one block only, has a theoretical mechanical advantage of 1:1 in the lifting mode (550), that is, no help at all even with a perfect pulley, but in the towing mode (551), sometimes called a **Single Whip Tackle**, it is 2:1, quite useful even with only a smooth rod as "sheave". However, if you just have a rope loop as sheave, you would be as well off with a direct pull, except that you would have less control. If the direction of pull is for any reason inconvenient, change it by using a runner, attached to any convenient anchorage. Lifting a heavy weight, needing the combined pull of several people, is best done with a horizontal pull rather than have people trying to scramble up the rope. Except for the Whip Tackle (552), I show only one mode of each tackle, depending on what seems to be the most common use.

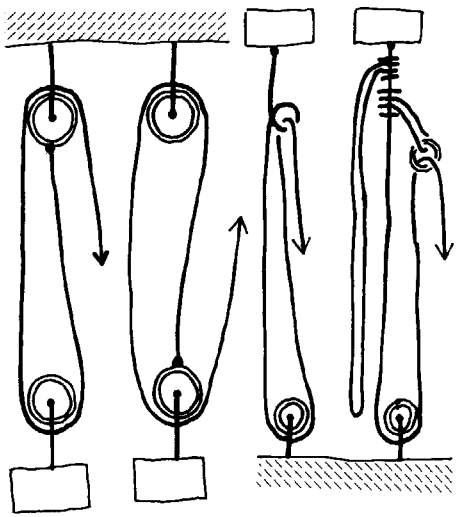
551. Single Whip Tackle

If you cannot use the standard physical principles to calculate the theoretical mechanical advantage of a tackle system (before allowing for friction), you can measure it empirically. Set up the tackle, subject it to sufficient load to take up all slack, and then pull on it: the mechanical advantage is the ratio of the distance travelled by the end of the fall to the distance travelled by the load.

This calls attention to an important consideration when using improvised or emergency tackle. You need to have the ratio of the theoretical mechanical advantage to the number of "sheaves" as large as possible to get a reasonable practical advantage. At the same time, the greater the theoretical mechanical advantage, the greater the amount of rope that has to be pulled through the tackle for a given movement of the load, and with anything other than the Simple Tackles described below, the greater the number of times you have to reposition the tackle during operation in order to bring the load close to the anchorage.

SIMPLE TACKLES

The **Whip Tackle (552)** has two single-sheave blocks, one attached to the anchorage, one to the load; the fall leads over each sheave in turn and is fastened to the bottom of the first block. The theoretical mechanical advantage is 2:1 in the lifting mode (552A), 3:1 in the towing mode (552B). The Truckies Hitch (362) is an application of a Whip Tackle in the towing mode (552C), where the load "block" is a rope loop and the anchor "block" is the rail on the truck. This is quite a good emergency tackle, though it is generally better to have a more secure loop at the load, such as a Man Harness Hitch (54), or stabilise the loop with a toggle (which may be a stick or, e.g., a spanner) as in 364E. If you have it, clip a karabiner into the loop, or insert a thimble, or attach a metal ring to the rope with a Cow Hitch (379E,F) or other suitable knot. For the anchor "block", the anchor itself may be used if it is smooth and not too large in diameter, otherwise attach another loop, if possible with a karabiner or the like.



552A 552B 552C 552D

552. Whip Tackle

Tackles are made fast either by fastening the running end of the fall to an anchorage, or by using the fall, perhaps in the bight, to make two Half Hitches round all returns close up to the block that the fall leads into; lighter loads can be held by a Bosuns Hitch (359).

In some rescues, you need to pull a person up a cliff. This can be troublesome, but if the cliff edge and the anchorage are suitable, various tackles may be used to help, of which the Whip Tackle in the towing mode is the simplest. In general, you cannot place your load "block" close to the load, as it has to be in reach from the top. This means that the lift has to be in stages. This can be arranged by attaching the load "block" (usually a karabiner) with a sling using a Prussik Hitch (453). You also need a safety rope attached with a Prussik Hitch either just above or just below the other (552D). Lift as much as you can on the tackle. If your safety rope is on the load side of the Prussik Hitch, hold the load on the tackle, slide the safety rope forward and hold the load on it while you move the load "block"; if the safety rope is below, take the load on the safety rope and slide the load "block" forward.

The next four tackle systems (553–556) use multiple-sheave blocks. These may be metal engineering blocks, or traditional wooden ones. The theoretical mechanical advantage in these systems is equal to the number of ropes leaving the moving block; this applies to both lifting and towing modes.

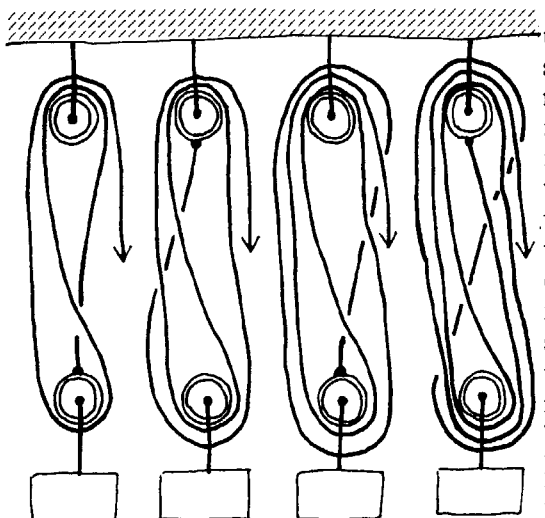
It is possible to pass the rope simply round and round to the end and fasten it to the appropriate block, but this can have two disadvantages. With blocks containing three or more sheaves, the rope leads to one side, canting the block under load and adding greatly to the friction. Secondly, particularly with laid rope, the tackle tends to twist badly, again increasing friction. These can be minimised by starting with the centre sheave and by changing direction of the reeving from time to time. I show methods for blocks up to three-sheave. When these tackles are in use, the blocks turn at right angles to one another.

Full-sized tackles are reeved by two people. Place the blocks on their

sides about 2 m apart, with the two people standing back to back in the middle, astride the tackle. Each threads the rope over one sheave and passes the end between the legs to the other.

If the blocks have different numbers of sheaves, the one with most is reeved first, and is here designated the top block; if they have the same number, it does not matter which is which. The coil of rope should be to the right of the person reeving the top block. Note that the present terms top and bottom block need not refer to the way in which the tackle is used.

To make the diagrams clearer, the sheaves have been drawn of different diameters, with the smallest on top.



553. Luff Tackle 554. Gun Tackle 555. Light Gyn Tackle 556. Heavy Gyn Tackle

The **Luff Tackle (553)** uses one double and one single block. The theoretical mechanical advantage is 3:1 in the lifting mode. The fall is reeved from the right through the bottom sheave of the top block to the sheave of the bottom block; change direction, and pass the rope from the left through the top sheave of the top block. Pass the rope under the return and make fast to the becket of the bottom block with two Half Hitches seized or a Buntline Hitch (344).

The **Gun Tackle (554)** uses two double blocks; the theoretical mechanical advantage is 4:1 in the lifting mode. Start with the becket of the top block underneath. The fall is reeved from the right through the bottom sheave of the top block to the top sheave of the bottom block; change direction and pass the rope from the left through the top sheave of the top block to the bottom sheave of the bottom block. Pass the rope under all the returns and make fast to the becket of the top block with two Half Hitches and seize or a Buntline Hitch (344).

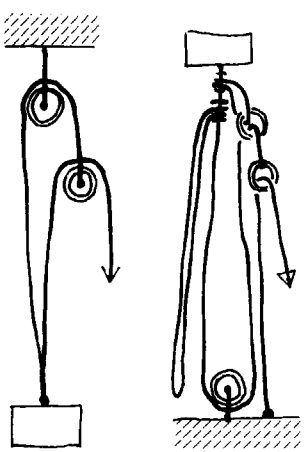
The **Light Gyn Tackle (555)** uses one double and one triple block; the theoretical mechanical advantage is 5:1 in the lifting mode. Start with the becket of the bottom block underneath. The fall is reeved from the right through the centre sheave of the top block to the top sheave of the bottom block. Change direction and pass the rope from the left through the top sheave of the top block to the bottom sheave of the bottom block and the bottom sheave of the top block. Pass the rope under the returns and make fast to the becket of the bottom block with two Half Hitches and seize or a Buntline Hitch (344).

The **Heavy Gyn Tackle (556)** uses two triple blocks; the theoretical mechanical advantage is 6:1 in the lifting mode. Start with the becket of the top block on top. The fall is reeved from the right through the centre sheave of the top block to the top sheave of the bottom block; change direction and pass the rope from the left through the top sheave of the top block to the bottom sheave of the bottom block. Passing under all returns, change direction and pass the rope from the right through the bottom sheave of the top block to the centre sheave of the bottom block and make fast direct to the becket of the top block with two Half Hitches and seize or a Buntline Hitch (344).

DOUBLE TACKLES

A simple way of increasing the power of a tackle is to put another tackle on the fall of the first. The theoretical mechanical advantage of the combined tackle in the towing mode is obtained by multiplying together the mechanical advantages of the individual tackles. However, the load cannot be brought close to the anchorage. The second tackle may have to be removed from the fall of the first and refastened further along, meanwhile holding the load on another rope with a Stopper Hitch (459) on the main rope, or use slings and Prussik Hitches as in 552D.

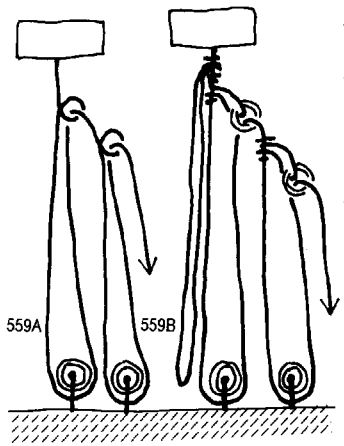
The **Spanish Burton (557)** is in effect two Single Whips (551) in series. It has a theoretical mechanical advantage of 3:1 in the lifting mode, 4:1 (2×2) in the towing mode. Two single blocks and either two ropes are both fastened to the load or one rope is fastened to the load in the middle. One rope passes through a block fastened to the anchorage; another block is fastened to its end. The second rope passes through the second block and is used for pulling.



557. Spanish Burton 558. Pulley Tackle

The **Pulley Tackle (558)** is a Single Whip pulling on the fall of a Whip Tackle in the towing mode, that being the only application I have seen. Three single blocks and two ropes are needed, and the theoretical mechanical advantage in this mode is 6:1 (2×3). I have shown the setup used in rope rescue, with a safety rope attached with a Prussik Hitch and the load block attached with another sling and Prussik. One rope leads from the load, round the anchorage block, and then the load block; the intermediate block is attached to its end. The second rope is attached to the anchorage and leads through the intermediate block and back, and is the end used for working. The Prussik Hitches are manipulated as for 552D.

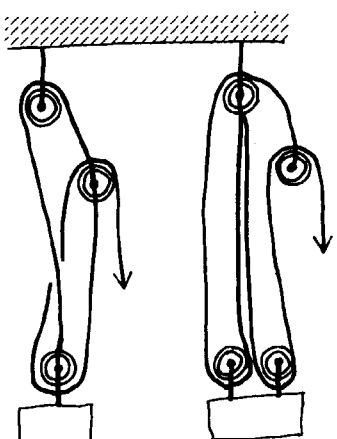
The **Double Truckies Tackle (559)** is in effect a Whip Tackle in the form



559. Double Truckies Tackle

of a Truckies Hitch (362) attached to a second one (559A). It uses only one rope but four "blocks" and the theoretical mechanical advantage is 9:1 (3×3) in the towing mode. This gives probably the greatest practical mechanical advantage of any tackle using at least two wholly rope "blocks". Truckies use it to give maximal tightening to a rope over a load. The same setup can be used in rope rescue (559B), arranged and manipulated as described in 552D.

COMPLEX TACKLES


560. Double Spanish Burton

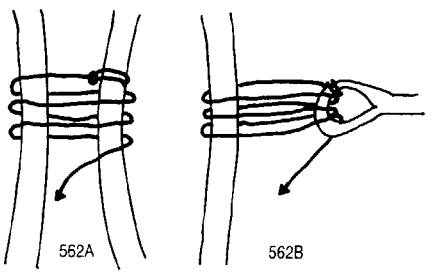
561. Bell Tackle

The **Double Spanish Burton (560)** uses two ropes and three single blocks to give a theoretical mechanical advantage of 5:1 in the lifting mode. It could be considered a Whip Tackle attached to a Single Whip Tackle, with a little rearrangement. Its main use has been on merchant ships. One block is attached to the load, one to the anchorage and the third is attached by a rope passing through the top block to the load (or, often, the bottom block). Pull is taken on a rope running through the intermediate and the bottom blocks to the becket on the intermediate block.

The **Bell Tackle (561)** uses two ropes (or a single rope attached at its middle) and four single blocks or two single blocks and one double, to give a theoretical mechanical advantage of 7:1 in the lifting mode. One single block is attached to the anchorage and two, or the double, to the load; the intermediate block attached by a rope through the top and one of the bottom blocks to the becket of the top block. Pull is taken on a rope passing through the intermediate block and the other bottom block to the becket of the top block.

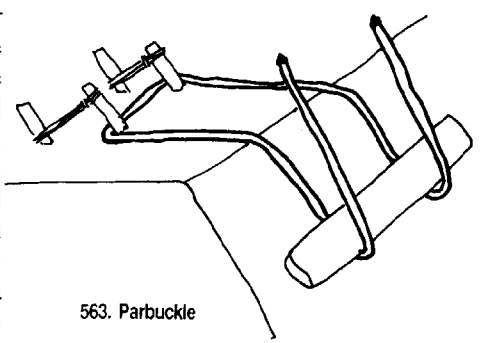
OTHER WAYS OF GAINING MECHANICAL ADVANTAGE

Tricing (562) was used in a number of traditional nautical applications, such as bringing together two ropes under tension (562A) or bringing an eyed rope close to another rope also under tension (562B). Using light line, start with a Clove Hitch secured with two Half Hitches on one rope, or on the eye, pass the line round both ropes several times, pull tight (that is, trice up) and fasten with a Round Turn and Two Half Hitches to the rope you did not start on, or with two Half Hitches applied as frapping turns round all returns.

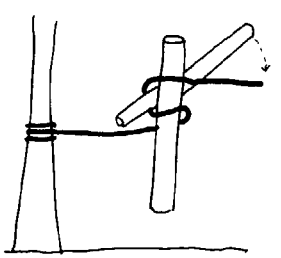


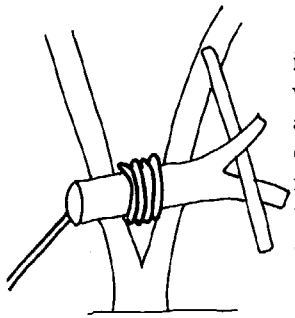
562. Tricing

A **Parbuckle (563)** is used for raising a long narrow load. The bight of a rope is passed round the anchorages and the two ends passed under the load and round back; pulling on both ropes together raises the load. It was normally used for a rolling load, when a rough rope with maximal friction is desirable, but if the load cannot roll, a smooth rope that will readily slide round the load is better.


563. Parbuckle

A **Spanish Windlass (564)** gives a strong pull on a rope over short distances. You need a stout upright spar, held steady with one end on the ground by one person, a strong lever spar worked by a second person, and an anchorage. Rig the rope as shown. As the windlass is worked, it moves towards the anchorage at half the speed of the load. If you need to winch any distance, you will need to hold the load with a Stopper Hitch (459) or Prussik Hitches as in 552D while you remove the windlass and reset it. If your load is heavy, beware of the windlass slipping: the lever can break bones!


564. Spanish Windlass



565. Bush Windlass

A Bush Windlass (565) gives a good pull but is a bit of trouble to set up. You need a sound tree with a low fork, or two trees close together as anchorage, and a good log with a strong fork at one end as windlass, with the arms of the fork notched to take the lever. The main rope is attached to the windlass with a secured Clove Hitch and some riding turns.

PART SIX

FINDING THINGS

Up to this point, the knots in this book have been arranged according to the structure of the knot. This, it is hoped, will help you understand how knots work. However, when you want to find a particular knot, or if you want to find a knot suitable for a particular purpose, extra help is needed. Chapter 27 helps you for the latter purpose, the Index of Illustrations for the former. The Index of Concepts helps you find the meaning of technical terms, or where to find particular topics.

Chapter 27
SUMMARY OF APPLICATIONS

If you set out to use a knot for a purpose where anything at all important hangs on the knot being the right one for the purpose, on the knot being correctly tied, or on the way in which the knot is used, then you will find that you cannot learn all that you need in this book. Indeed in most cases, you cannot learn everything about the safe and efficient use of knots out of any book; there is no substitute for practical experience, and in important applications, you need actual practical guidance from an experienced person. This Chapter merely lists suitable applications for the knots, but does not attempt to discuss all the precautions or tricks of the trade needed for a satisfactory outcome. Where several knots are listed for the one purpose, read the main text for each knot to decide which one to use.

Attention is again called to the properties of a good knot, indicated in the introduction to Part Four and the last section of Chapter 22.

KNOTS FOR PARTICULAR MATERIALS

Matching Knot and Rope

The rope that you use should be of appropriate diameter, not only for strength but also for whatever handling it will get. If you are pulling on the rope by hand, rope is best about 10–12 mm diameter, certainly not less than 7 mm. If you want to climb the rope hand over hand, a diameter of 15–20 mm is better. If mechanical devices like pulleys, winches or even karabiners are used, maximum and minimum limits are also applicable.

It is best to use a soft rope for hitches or binding knots round a hard object, and a hard rope for soft objects.

Kernmantle rope is stiff, smooth and relatively unsquashable, so that the choice of knots is critical, even if the rope is not being used for life support.

Knots may be tied in quite a variety of substances as well as rope. The choice of knot depends, as with rope, on the roughness of the surface and the flexibility of the material. Compressibility is also of importance, but often goes with flexibility.

The stiffest materials used to tie knots are probably monofilament soft wire, such as fencing wire, and straps of leather or the like. Only very simple knots can be tied, often based on Half Hitches rather than Overhand Knots.

So-called flexible wire rope is rarely flexible enough for knotting, except for the kinds of knot tied in slings.

Somewhat more flexible are the fabric tapes of the kind used by mountaineers. It is usually undesirable to allow too much deformation of the tape when tying knots, so that simple knots of open construction are needed.

Twines and threads are much more flexible, but their small size makes some intricate knots too difficult to tie. On the other hand, the materials are usually so cheap that there is no need to tie knots that can be readily untied—they can be just cut off.

Fishing lines are also of small diameter, but are often stiffer and more slippery than twine. At the same time, fishers want to lose as little strength as possible due to the knots, so knots incorporating many turns, dissipating the load only gradually, are common.

Chain combines maximal flexibility between links with the equivalent of maximal friction between two chains crossing. Consequently, knots involving many crossings jam very readily, but simple knots serve well.

It is generally best to avoid using ropes of very different properties together, particularly if the load is shared between the ropes, as the loading would be very uneven. If you must use them, any knots should involve minimum contact between the two, and any nips in the ropes should preferably involve only one rope at a time.

Knots for Slippery Synthetic Ropes

Many of the simpler knots that were traditionally recommended for general use with natural fibre ropes tend to slip if tied in synthetic ropes. However, many of these can be made more secure by doubling turns, adding extra tucks, or securing the running ends. I have already listed many examples in Chapter 22, specially the sections on Extra Tucks and Turns in Hitches, Extra Tucks or Turns in Loops and Bends, and Extra Security. Many, but not all, of the knots listed as Double. . . in the Index of Illustrations are suitable. Many of the multi-turn knots recommended for use with monofilament fishing line and listed later in this Chapter are quite suitable, though maybe not as many turns are needed.

A good bend is the Double Fishermans Knot (109); good end-loops are the Figure Eight Loop (309) and the Double Fishermans Loop (112); and a good mid-loop is the Alpine Butterfly Loop (123). It is often good to substitute a Buntline Hitch (344) for Two Half Hitches (337) in such applications as the Fishermans Bend (348) or the Round Turn and Two Half Hitches (340), though it may jam hard if subjected to heavy load. If you use such snug hitches as the Clove Hitch (372), you need to take particular care that the load is shared between the two ends.

Knots for Twine or Thread

Many of the knots listed below for fishing are suitable for use in thread or twine, except that single or double turn versions of the multi-turn knots are usually quite adequate. The knots listed below for Parcels and for General Purposes are nearly all suitable for use with twine. Often the slipped versions are suitable and make for easy removal.

Bends include the Blood Knot (49); Wire Bend (53); Binder Turn (70); Fishermans Knot (103); Mohair Knot (133); Reef Knot (165) and Surgeons Knot (173) and their slipped and secured derivatives; Weavers Knot (404) and Double Weavers Knot (414); Capsized Carrick Bend (477).

Loops include the end loops Packers Tie (65); Slip Overhand Loop (66); Double Overhand Loop (138); the mid loop Man Harness Hitch (54); and nooses Poachers Noose (85) and Running Figure Eight Noose (290).

Stopper Knots include the Thumb Knot (58E) and the Bead Knot (148).

Hitches include the Builders Hitch (46); Constrictor Knot (150); Clove Hitch (372); and Round Turn and Two Half Hitches (340).

Knots for Materials Other Than Rope

Hay, Grass and other natural materials: Binder Knot (43); Strap Bend (48); Fishermans Knot (103); Mohair Knot (133); Grass Knot (163).

Straps, Tape, Webbing: Strap Bend (48); Double Strap Bend (52); Tape Knot (132); Frost Knot (135); Grass Knot (163); Strap Sennit (500).

Wire: Cobb & Co Hitch (44); Haywire Twist (45); Strap Bend (48); Double Strap Bend (52); Wire Bend (53); Wire Tie (88D); Fishermans Knot (103); Surgeons Half Knot (149); wire to rope or nylon fishing line: Nail Knot (94D); Albright Knot (212); wire rope: Grommet Splice (252); Tail Splice for fencing wire (253), to laid rope (262), to braided rope (275); see also Knots for Slings below.

Chain: Lever Hitch (91); Clove Hitch (372); Two Half Hitches (337); Single Blackwall Hitch (358) and Double Blackwall Hitch (320) to a hook; Stopper Hitch (459) to a rope; Chain Splice (267) to multiplait rope.

Knots for Slings, Snotters or other Continuous Loops

Bends: Two Loops Knot (166A) and its Toggled (166C) and Slip-Toggled (166D) variants; Loop Handle Knot (167); to a single rope: Becket Hitch (396); Double Becket Hitch (413); Slip Becket Hitch (423).

Bottle Knots: Fishermans Bottle Knot (106); Alpine Butterfly Bottle Knot (126); Overhand Sling Knot (147D); Pipe Sling (199).

Harness: Diaper Harness Knot (222); Chest Harness Knot (223).

Hitches: to cask: Cask Sling (332); to vertical spar: Pipe Sling (199); Bale Sling Hitch (328); Diagonal Sling Hitch (331); to horizontal spar, bale: Bale Sling Hitch (328); Running Eye (380); Double Bale Sling Hitch (454); to rope: Bachmann Knot (206); Hedden Hitch (329); Cross Prussik Hitch (330); Prussik Hitch (453).

Shortening: Overhand Sling Knot (147C); Reef Shortening (172).

BASIC FUNCTIONS

Bends

Heavy Hawsers: ropes of equal diameters: Single Carrick Bend (161D); Reeving Line Bend (335); Hawser Bend (336); Twin Bowline Bend (431); ropes of unequal diameters: Bowline Bend (430); Carrick Bend (472); Capsized Carrick Bend (477); ropes of very unequal diameter (hawser to heaving line): Bowline Bend (430); Manyfold Sheetbend (413); Seizing Bend (417).

Twine and Thread: see also sections on Knots for Twine and Thread above and on Fishing Knots below; twines of equal thickness: Mohair Knot (133); Weavers Knot (404); Double Weavers Knot (414); twines of unequal thickness: Blood Knot (49); Wire Bend (53); Fishermans Knot (103); Double Fishermans Knot (109); Overhand Bend (130A); Fishermans Eight Knot (303); Capsized Carrick Bend (477).

T-Bends: one rope has its ends unavailable: T-Bend (403); Dropper Bend (407); Rolling Hitch (457); Slip Rolling Hitch (458); Stopper Hitch (459); Double Rolling Hitch (460).

Loops: single rope to a loop: Becket Hitch (396); Double Becket Hitch (413); Slip Becket Hitch (423).

Collection Bends: one rope to several: Collection Knot (131); Multiple Sheetbend (416); Two to One Bend (428).

Decorative Bends: Matthew Walker Bend (115D); Square Knot (322); Josephine Knot (482); Elongated Carrick Mat (488); Round Sennit Bend (511).

Adjustable Bends: lengths of standing parts and distance between the two parts of the knot adjustable: Overhand Adjustable Bend (108); Adjustable Bend (461).

Bends between Materials other than Rope: see also section on Knots for Materials other than Rope above: Strap Bend (48); Double Strap Bend (52); Wire Bend (53); Fishermans Knot (103); Tape Knot (132); Albright Knot (212); Chain Splice (267); Tail Splice (253, 262, 275).

Multistrand Knots: Common Shroud Knot (237); Diamond and Double Diamond Shroud Knots (238).

Splices: Short Splice (257); Long Splice (259); multiplait Short Splice (265); End to End Splice for hollow plaits (271); for braids (273); for double braid (277); Tapering Splice (274).

Other Bends for Ropes of Equal Thickness: Alpine Butterfly Bend (124); Riggers Bend (128); Double Riggers Bend (129); Ring Knot (132); Whatnot or Jinx (162E); Reef Knot (165); Stopped Reef Knot (168); Secured Reef Knot (169); Clinched Reef Knot (170); Tucked Reef Knot (171); Slip Reef Knot (178); Reef Bow (178); Secured Reef Bow (184); Clinched Reef Bow (185);

Riggers Eight Bend (308); Short End Bend (406); Corrick Bend (480).

Other Bends for Ropes of Unequal Thickness: all of these knots can also, of course, be used with ropes of equal thickness: Binder Turn (70); Fishermans Knot (103); Double Fishermans Knot (109); Fishermans Eight Knot (303); Flemish Bend (313); Sheetbend (395); Facing Sheetbend (401); Secured Sheetbend (410); Rivermans Bend (412); Double Sheetbend (413); Turn-Tucked Sheetbend (418); Loop-Tucked Sheetbend (419); Enhanced Sheetbend (422); Slip Sheetbend (423); Loop-Slipped Double Sheetbend (424); Toggled Sheetbend (425); Bowline Bend (430); Capsized Carrick Bend (477).

Binding Knots

Tied as a Bend: Binder Knot (43); Drawstring Slip Stopper (64F); Bouquet Knot (107); Half Knot (141); Reef Knot (165); Stopped Reef Knot (168); Secured Reef Knot (169); Clinched Reef Knot (170); Surgeons Knot (173); Double Surgeons Knot (174); Slip Reef Knot (177); Reef Bow (178); Surgeons Bow (179); Shoelace Knot (180); Stationers Knot (181); Parcel Knot (182); Shoestring Knot (183); Secured Reef Bow (184); Clinched Reef Bow (185); Packet Knot (338); Suture Knot (402); Bookbinders Knot (408).

Tied as a Snug Hitch: Cobb & Co Hitch (44); Bag Knot (93); Marline Hitch (143); Double Marline Hitch (145); Constrictor Knot (150); Slip Constrictor (151); Double Constrictor (152); Two-Twist Constrictor (153); Perpendicular Butterfly Knot (154); Strangle Knot (155); Slip Strangle Knot (156); Double Strangle Knot (157); Parallel Butterfly Knot (158); Pipe Sling (199); Clove Hitch (372); Oklahoma Hitch (374); Climbers Bowline (409); Girdle Knot (427); Jam Hitch (449); Spar Hitch (462); Millers Hitch (463); Bag Hitch (465).

Crossing Knots

Overhand Crossing Knot (89); Half Knot (141); Constrictor Knot (150); Granny Knot (161C); Crossing Knot (318); Zigzag Knot (319); Square Knot (322); Reciprocal Crossing Knot (324); Pile Hitch (325); Clove Hitch (372); Oklahoma Hitch (374); Cow Hitch (379); Spar Hitch (462); Millers Hitch (463).

Hitches

Belay Hitches: to finish with the standing part tight: Halyard Coil (27); Builders Hitch (46); Overhand Mooring Hitch (142); Two Half Hitches (337); Two Slipped Half Hitches (339); Round Turn and Two Half Hitches (340); Racking Hitch (342); Jumper Hitch (343); Belaying Hitch (357); Bosuns Hitch (359); Truckies Hitch (362); Double Truckies Tackle (559).

Loose Hitches: Midshipmans Hitch (446); Midshipmans Back Hitch (447); Midshipmans Bucket Hitch (448); Jam Hitch (449); Rolling Hitch (457); Slip Rolling Hitch (458); Double Rolling Hitch (460);

Snug Hitches, Perpendicular Pull: Lever Hitch (91); Jury Knot (101); Shamrock Knot (119); Donkey Hitch (146); Eight Hitch (295); Stevedore Hitch (298); Sennit Snug Hitch (302); Anchor Hitch (310); Pile Hitch (325); Double Pile Hitch (326); Fishermans Bend (348); Gaff Topsail Halyard Bend (350); Stunsail Halyard Bend (353); Topsail Halyard Bend (354); Clove Hitch (372); Jammed Clove Hitch (375); Cow Hitch (379); Running Eye (380); High Post Hitch (383); Magnus Hitch (450); Magnus Cow Hitch (451); Roband Hitch (451); Tree Surgeons Knot (455); Spar Hitch (462); Ossel Hitch (467); Snug Hitch (468); Two-Tuck Snug Hitch (469); Net Line Hitch (471).

Ring Hitches: Halter Hitch (79); Bale Sling Hitch (328); Slippery Hitch (334); Two Half Hitches (337); Two Slipped Half Hitches (339); Round Turn and Two Half Hitches (340); Buntline Hitch (344); Fishermans Bend (348); Cow Hitch (379); Running Eye (380); Draw Hitch (384); Ring Bowline (399); Bowline (400); Release Bowline (426); Portuguese Bowline (440); Splayed Portuguese Bowline (441); Midshipmans Hitch (446); Rolling Hitch (457); Millers Hitch (463).

Hitches to a Plank, Perpendicular Pull: Lever Hitch (91E); Oklahoma Hitch (374D); Scaffold Hitch (470).

Quick Release Snug Hitches: Slip Eight Hitch (296); Slip Fishermans Bend (349); Towing Hitch (352); Slip Clove Hitch (373); Toggled Cow Hitch (381); Twist-Toggled Cow Hitch (382); Draw Hitch (384).

Snug Hitches, Longitudinal Pull: if the object you are pulling on is slippery, rub ashes when wet, or parcel with canvas, sacking, or rubber, as from an inner tube; Lifting Hitch (210); Pipe Hutch (211); Timber Hitch (300); Killick Hitch (300); Double Timber Hitch (301); Double Pile Hitch (326); Icicle Hitch (327); Hedden Hitch (329); Cross Prussik Hitch (330); Prussik Hitch (453); Tree Surgeons Knot (455); Stopper Hitch (459).

Loops

Single Loops, Open Eye: Bimini Twist (47); Honda Loop (86); Bowstring Knot (86A); Locked Crabbers Eye (88B); Corrick Loop (481).

Single Loops, Closed Eye: Packers Tie (65); Store Knot (67); Tucked Overhand Single Loop (68); Anglers Loop (71); Algonquin Bowline (74); Fishermans Loop (104); Double Fishermans Loop (112); Alpine Butterfly End Loop (126); Matthew Walker Loop (115F); Overhand Loop (134); Double Overhand Loop (138); Thumb Loop (139); Heaving Loop (215); Double Tie (284); Rover Knot (288); Fishermans Eight Loop (304); Figure Eight Loop (309); Figure Nine Loop (314); Stevedore Loop (315); Twisted Loop (316); Sennit Loop (317); Ring Bowline (399); Bowline (400); Cast Bowline (405); Climbers Bowline (409); Water Bowline (411); Double Bowline (415); Tucked Bowline (420); Enhanced Bowline (421); Bowline with a Bight (433); Painters Bowline (434).

Single Loops, Quick Release: Slip Overhand Loop (66); Slip Anglers Loop

(72); Slip-Tucked Figure Eight Loop (287); Slip Bowline (424); Slip Double Bowline (424); Release Bowline (426).

Single Loops, Spliced: Sewn Splice (246); Single Cobblers Splice (247); Double Cobblers Splice (248); Stuck Splice (249); Flemish Eye (250); Hard Plait Eye (251); Grommet Splice (252); Eye Splice, laid rope (255), multiplait (264), hollow plait (269), double braid (276); Rapid Eye Splice (270); Lock Tuck Splice (272).

Single Loops, mid: for three-way pull: Man Harness Hitch (54); Double Man Harness Hitch (55); Blood Dropper Loop (56) Middlemans Knot (105); Alpine Butterfly Loop (123); Overhand Back Loop (136); Figure Eight Back Loop (311); Linesmans Loop (367); Single Bowline on a Bight (420F).

Single Nooses, Loose: Running Figure Eight Noose (290); Butchers Knot (290); Running Bowline (429).

Single Nooses, Tight: Overhand Noose (77); Slip Overhand Noose (78); Halter Hitch (79); Secured Overhand Noose (80); Reel Knot (81); Poachers Noose (85); Gallows Knot (85C); Crabbers Eye (88); Grinner Knot (95B); Strangle Noose (155C); Standing Figure Eight Noose (289); Crossed Figure Eight Noose (291); Snare Noose (292); Hangmans Noose (293); Buntline Hitch (344); Corned Beef Knot (346; Sash Weight Knot (351 Jam Hitch (449).

Double Loops, Parallel Eyes: Tucked Overhand Double (69); Double Anglers Loop (73); Double Honda Loop (87); Figure Eight Double Loop (312); Locked Bowline (436); Bowline on a Bight (437); Portuguese Bowline (440); Locked Portuguese Bowline (444).

Double Loops, Perpendicular Eyes: Twin Overhand Loop (96); Firemans Chair Knot (99); Sheepshank Loop (365); Spanish Bowline (368); Locked Spanish Bowline (369); Splayed Portuguese Bowline (441).

Twin Loops: Twin Loops Knot (159); Sister Loops (445).

Double Nooses: Tom Fools Knot (97); Handcuff Knot (98).

Multiple Loops: Jury Knot (101); Shamrock Knot (119); Triple Bowline (435); Bowline on a Skein (439); Bowline on a Coil (442); Portuguese Bowline on a Bight (443).

Stopper Knots

Knots: Overhand Knot (58); Thumb Knot (58E); Banana Knot (61); Double Overhand Knot (62); Float Stopper (62E); Quadruple Overhand Knot (63); Slip Overhand Knot (64); Release Knot (64E); Oystermans Stopper (82); Nail Knot (94D); Bead Knot (148); Figure Eight Knot (279); Figure Nine Knot (280); Stevedore Knot (281); Sennit Knot (283); Racking Knot (285); Figure Eight Loop (309).

Strand Knots: Single-Strand Overhand Knot (59); Crown Knot (224); Doubled Crown Knot (225); Wall Knot (226); Duo Wall Knot (227); Double Wall Knot (228); Matthew Walker Knot (229); Doubled Wall Knot (230); Double Matthew Walker Knot (231); Diamond Knot (232); Double Diamond Knot (233); Manrope Knot (239); Footrope Knot (244).

Splices: Back Splice, laid rope (256), multiplait (266), hollow plait (268), double braid (278).

Knobs

Knots: Heaving Line Knot (213); Quadruple Heaving Line Knot (217); Chinese Button Knot (475); Double Chinese Button Knot (476); English Button Knot (479); Globe Knot (496).

Strand Knots: Manrope Knot (239); Diamond Rose Knot (240); Stopper Knot (241); Cat Stopper Knot (242); Rose Knot (243).

Shortening Knots

Those marked * are also used to temporarily isolate a weak section.

Chain Sennit (75); Lever Sheepshank (92)*; Tom Fools Knot (97); Alpine Butterfly Loop (123)*; Overhand Loop (134)*; Overhand Sling Knot (147); Reef Shortening (172); Single-Strand Threefold Plait (282); Bellringers Knot (360); Double Bellringers Knot (361); Sheepshank (364)*; Double Sheepshank (366)*; Locked Sheepshank (432)*.

Whippings

Twine: Common Whipping (12); West Country Whipping (13); Palm and Needle Whipping (14); Chain Serving (76A); Constrictor Knot (150); Slip Constrictor (151); Double Constrictor (152); Two-Twist Constrictor (153); French Whipping (376).

Splices: Back Splice, laid rope (256), multiplait (266), hollow plait (268), double braid (278).

Coils and Hanks

Coils: using a continuous length of rope: Bound Coil (24); Hanging Coil (25); Rope Hanks (26); Halyard Coil (27); Climbers Coil (28); Chained Coil (29); Bowline on a Skein (439); Bowline on a Coil (442).

Hanks: using a number of short lengths: a Collection Knot (131) or Marline Binding (144) keeps the lengths together, but if you want to withdraw single lengths, use a Multiple Sheetbend (416) round a combined bight, or plait groups, or make a combined bight and separate into three groups, using a Three-Strand Common Sennit (503).

SPECIAL FUNCTIONS

Ladders

Single Rope: Overhand Knot (58), perhaps tied as a Chain of Overhands (60); Alpine Butterfly Loop (123); Etriers (135C).

Two Ropes: Reef Lanyard (187); Surgeons Lanyard (188); Ladder Knot

(323); or make Man Harness Hitches (54) on one rope and insert the bights into Lever Hitches (91) in the other, stopping the ends of the bights with Overhand Knots (58).

Rope Rungs, Ratlines: fasten on to legs with Clove Hitches (372), suitably secured; it may be necessary to place collars below the rungs: Constrictor Knots (150) may be suitable; alternatively, if the legs are laid rope, insert the rungs between the strands before tying the Clove Hitches.

Wooden Rungs: fastened to ropes with Lever Hitches (91), Stevedore Hitches (298) or Man Harness Hitches (54J); again, if the legs are laid rope, insert the rungs between the strands and place strong and firm Whippings (West Country Whippings, 13, probably best) above and below the rung.

Bottle Knots

These are also used for jugs, pitchers and the like; the Pile Hitch (325) or the Double Bale Sling Hitch (454) provide single pairs of ropes as handles. Two pairs of ropes for double handles are provided by the Tom Fools Knot (97); Fishermans Bottle Knot (106); Jury Knot (101); Matthew Walker Bottle Knot (115G); Alpine Butterfly Knot (125) or Overhand Sling Knot (147): if wanted, join the handles with a Loop Handle Knot (169); if there is a suitable rim at the bottom, it may be best to fasten the Bottle Knot there and seize the loops to the neck.

Heaving Line Weights

If you wish to throw the end of a rope for any distance, it is best to have some weight at the end; tying on a stone or a stick is not always satisfactory, specially if you are throwing the rope to a person who may be injured by the weight, so use a knot. Heaving Line Knot (213); Heaving Loop (215), Quadruple Heaving Line Knot (217), Round Heaving Line Knot (218), Racking Knot (285), Hanging Heaving Line Knot (294); for a permanent knot, consider the Monkeys Fist (497). To tie on to a hawser, use a Bowline Bend (430); Manyfold Sheetbend (413); Seizing Bend (417).

Chair Knots

It is uncomfortable to take all your weight sitting in a single loop of rope; either place a loop under each thigh, or share some of the load with a rope under the arms. A Bowline on a Bight (437) or a Portuguese Bowline (440) is best suited to a loop under each thigh; a Portuguese Bowline on a Bight (443) allows two ropes under each thigh, spreading the load further; a Richardson Harness Knot (99D) has a loop under each thigh but holds the body upright. One loop for the thighs and another for the arms are provided by the Firemans Chair Knot (99) or Spanish Bowline (368), and one loop for each thigh and another for the arms is provided by a Triple Bowline (435), probably the most comfortable of the all-rope chair knots. A more comfortable seat is provided

by using a Chain Sennit (75) or a Single-Strand Threefold Plait (282) in the appropriate place.

A wooden plank is much more comfortable to sit on; it may be suspended by a Lever Hitch (91E), Oklahoma Hitch (374D) or Scaffold Hitch (470) at each end. These hold better if the plank is grooved, but if you are going to modify the plank, it might be best to drill holes to take the rope, passing the rope lengthways diagonally under the plank as a safety precaution; this arrangement is known as a Bosuns Chair.

Neither a chair knot nor a bosuns chair is suitable to carry an unconscious or otherwise incompetent person. In the absence of proper harnesses, use a Diaper Harness Knot (222) and a Chest Harness Knot (2123).

Netting

Diagonal Netting: uses only one yarn to give a stretchy mesh: the traditional knot is the Mesh Knot (397), but the Overhand Netting Knot (130B) is simpler and cruder, and the Carrick Netting Knot (485) more secure and more elegant; on the other hand, Knotless Netting (42) also has a place.

Square Netting: is used in cargo nets, scrambling nets and some safety nets, where a more rigid net that can be suspended and tensioned easily is needed. Essentially an open weaving technique is used, with a firm link at each crossing. An Overhand Crossing Knot (89) or a Clove Hitch (372) anchor one yarn securely, but the other can still move. This can be prevented by tying the knot into the strands of laid rope. A Square Knot (322) fixes both yarns, as does the Reciprocal Crossing Knot (324).

KNOTS FOR PARTICULAR OCCUPATIONS

General Purpose Knots

Almost anyone who uses rope, cord or twine is likely to have occasion to use these knots sometime. They will not be mentioned in the later sections unless they have special value in the particular application.

Bends: Fishermans Knot (103); Double Fishermans Knot (109); Overhand Bend (130A); Collection Knot (131); Sheetbend (395).

Loops: end loops: Overhand Loop (134); Figure Eight Loop (309); Bowline (400); mid loop: Man Harness Hitch (54); noose: Overhand Noose (77); Running Bowline (429).

Hitches: snug hitches: Clove Hitch (372); Cow Hitch (379); loose hitches: Round Turn and Two Half Hitches (340); Rolling Hitch (457); tightening knots: Slippery Hitch (334B); Truckies Hitch (362).

Stopper Knots: Overhand Knot (58); Figure Eight Knot (279).

Binding Knots: Constrictor Knot (150); Reef Knot (165).

Shortenings: Chain Sennit (75).

Coil: Rope Hank (26).

see also: Knots for Domestic Use; Knots for Parcels below.

Knots for Domestic Use

Clothing: shoes: Slip Reef (177); Reef Bow (178); Shoelace Knot (180); Shoestring Knot (183); Secured Reef Bow (184); Clinched Reef Bow (185). Girdle: Girdle Knot (427); Heaving Line Knot (213); Drawstring Slip Stopper (64F). Ties: Reef Bow (178); Buntline Hitch (344); Jam Hitch (449). Stockings: Binder Knot (43C).

Bead Knots: Overhand Knot (58); Banana Knot (61); Bead Knot (148); Figure Nine Knot (280D).

Curtains: Donkey Hitch (146); Twin Loops Knot (159); Girdle Knot (427); Sister Loops (445).

Kitchen: Cork Tie (83).

see also: Knots for Parcels below

Knots for Parcels

Initial Loops: Packers Tie (65); Slip Overhand Loop (66); Store Knot (67); Overhand Noose (77); Poachers Noose (85); Butchers Knot (290A); Packet Knot (338); Corned Beef Knot (346).

Crossing Knots: Granny Knot (161C); Crossing Knot (318); Square Knot (322); Reciprocal Crossing Knot (324); Clove Hitch (372).

Fastenings: Reef Knot (165); Surgeons Knot (173); Slip Reef (177); Reef Bow (178); Stationers Knot (181); Parcel Knot (182); Shoestring Knot (183); Secured Reef Bow (184); Clinched Reef Bow (185).

Whole Wrappings: Chain Serving (76A); Marline Hitch (143); Double Marline Hitch (145).

Knots for Nautical Use

Bends: Sheetbend (395); Double Sheetbend (413); Carrick Bend (472); Capsized Carrick Bend (477).

Loose Hitches: Slippery Hitch (334); Round Turn and Two Half Hitches (340); relieving tension: Stopper Hitch (459); Rolling Hitch (457).

Snug Hitch: Jury Knot (101); Killick Hitch (300C); Anchor Hitch (310); Fishermans Bend (348); Gaff Topsail Halyard Bend (350); Stunsail Halyard Bend (353); Topsail Halyard Bend (354); Clove Hitch (372); Magnus Hitch (450).

Sails: Marline Hitch (143); Double Marline Hitch (145); Reef Knot (165); Roband Hitch (452); Shroud Knot (456).

Stopper Knot: Figure Eight Knot (279); Stevedore Knot (281).

Mooring: Overhand Mooring Hitch (142); Back Mooring Hitch (321); Pile Hitch (325); Double Pile Hitch (326); High Post Hitch (383).

Working: Marlinespike Hitch (91I); Scaffold Hitch (470).

Coil: Flaking (21); Figure Eight Coil (22); Halyard Coil (27).

see also Knots for Transport below; Chair Knots; Heaving Line Weights; Bends for Heavy Hawsers above.

Knots for First Aid and Surgery

Bandaging and Slings: Half Knot (141B); Reef Knot (165); Oklahoma Hitch (374D).

Emergency use: handkerchief as bandage: Binder Knot (43); stretcher: Chain Serving (76A); carrying stretcher: Spanish Bowline (368); Splayed Portuguese Bowline (441).

Surgery: Overhand Knot with forceps (58F–K); Surgeons Half Knot (149); Constrictor Knot (150); clinched Granny Knot (161); Reef Knot (165); Surgeons Knot (173), tied with forceps (173B–G); Double Surgeons Knot (174); Surgeons Bow (179); Suture Knot (402).

Knots for Transport

Block to Spar: Cross Prussik Hitch (330); Diagonal Sling Hitch (331); Block Lashing (542).

Tackle: see Chapter 26: Tackle; making fast: Bosuns Hitch (359).

Rope to Hook: Catspaw (50); Catspaw on the Running End (207); Double Blackwall Hitch (320); Hook Hitch (355); Single Blackwall Hitch (358); Bill Hitch (398); Bowline with a Bight (433).

Rope to Load: horizontal load: Bale Sling Hitch (328); Double Bale Sling Hitch (454); barrels: Barrel Sling (197); Double Barrel Sling (197C); Marline Barrel Sling (198); Cask Sling (332); vertical cylinder: Pipe Sling (199); Lifting Hitch (210); Pipe Hitch (211); Icicle Hitch (327); horizontal or vertical lift: Timber Hitch (300); Double Timber Hitch (301).

Tying up Sacks: Constrictor Knot (150); Millers Hitch (463); Bag Hitch (465).

Carrying Sacks: Bag Knot (93); Pack Sling (219); Cow Hitch (379); Single Blackwall Hitch (358).

Tying Down Load: Diamond Hitch (220); Squaw Hitch (221); Truckies Hitch (362); Double Truckies Tackle (559).

Towing: Ring Hitch (210); Back Mooring Hitch (321); Pile Hitch (325); Double Pile Hitch (326); Towing Hitch (352); High Post Hitch (383); Splayed Portuguese Bowline (441).

Bogged Vehicles: Chain Serving (76A); see also Chapters 25 and 26: Anchorages and Tackles.

see also Knots for Nautical Use, mooring; Knots for use with Animals, tying up.

Knots for Use with Animals; Farming

Tying up Animals: Halter Hitch (79); Donkey Hitch (146); Pile Hitch (325); Double Pile Hitch (326); Draw Hitch (384); Millers Hitch (463); Hobble

Knot (186).

Bridles: Rope Bridle (100); Matthew Walker Bottle Knot (115G).

Tying on Loads: Diamond Hitch (220); Squaw Hitch (221).

Snares: Poachers Noose (85); Snare Noose (292).

Farming: Binder Knot (43).

see also Knots for Materials other than Rope, above.

Knots for Construction, Building and Other Trades

Slinging Planks or Ladders: planks: Lever Hitch (91E); Oklahoma Hitch (374); Scaffold Hitch (470); ladders: Spanish Bowline (368); Splayed Portuguese Bowline (441).

Carrying Tools etc: Tool Hitch (370); Painters Bowline (434).

Taut Line: Builders Hitch (46).

Miscellaneous: Sash Weight Knot (351).

see also Chapters 23,24: Surveying, Lashings.

Weaving: Mohair Knot (133); Weavers Knot (404); Double Weavers Knot (414).

Bookbinding: Bookbinders Knot (408).

Knots for Fishers

knots recommended only for gut are marked *; knots incorporating multiple turns §.

Line to Reel: Reel Knot (81); Grinner Knot (95B); Arbor Knot (356).

Line to Line: equal thickness: Fishermans Knot* (103); Double Fishermans Knot* (109); Wolf Knot (110); Double Grinner Knot§ (111); Tape Knot* (132); Water Bend§ (140); Fishermans Eight Knot (303); unequal thickness: Blood Knot§ (49); Knotted Blood Knot§ (57B); Nail Knot§ (94D); Albright Knot§ (212).

Loop: Bimini Twist§ (47); Anglers Loop (71); Fishermans Loop* (104); Double Fishermans Loop (112); Double Overhand Loop (138); Thumb Loop§ (139); Heaving Line Loop§ (215); Double Tie§ (284); Figure Nine Loop (314); Stevedore Loop (315); Twisted Loop§ (316); Sennit Loop (317).

Line to Loop: Jam Knot (396B); Fly Knot (407C); Turn-Tucked Sheetbend (418).

Loop to Loop: Two Loops Knot (166).

Droppers: Blood Dropper Loop§ (56B); Overhand Dropper Knot (90); Figure Nine Loop (314); Stevedore Loop (315); Clove Hitch (372); Running Eye (380C); Dropper Bend (407).

Line to Swivel or Eye: Offshore Knot§ (51); Overhand Noose* (77); Grinner Knot§ (95B); Palomar Knot (137); Perfect Knot (209); Trombone Knot§ (216); Clinch Knot§ (299); Round Turn and Two Half Hitches* (340B); for wire: Haywire Twist§ (45); Wire Tie§ (88D).

Line to Eyed Hook, involving Shank: Turle Knot* (84B); Treble Turle Knot (84D); Two-Circle Turle Knot (84F); Snelling Knot§ (95D); Domhoff Knot§ (214); Eight Hitch* (295D); Nine Knot (297); Anglers Hitch (371); Jam Knot* (396C).

Line to Blind Hook: Whip Knot§ (94B); Snelling Knot§ (95D); Domhoff Knot§ (214); Tad Hitch (385).

Floats and Sinkers: Float Stop (62H); Release Knot (64E); Nail Knot§ (94B); Cow Hitch (379B).

Game Fish: to form double: Bimini Twist§ (47); Double Overhand Loop§ (138); Thumb Loop§ (139); Double Tie§ (284); double to eye: Offshore Knot§ (51); Grinner Knot§ (95B).

Deep Sea Fish: Millers Hitch (463); Ossel Hitch (467); Net Line Hitch (471).

see also Netting above.

Camping

Tent Guys: Slip Rolling Hitch (452).

Fastening Tent Walls: Marline Hitch (143); Double Marline Hitch (145); Donkey Hitch (146); Slip Reef (177); Roband Hitch (452).

Carrying Loads: load to pack frame: Diamond Hitch (220); Squaw Hitch (221); carrying unwieldy load: Pack Sling (219); Cow Hitch (379).

see also Chapter 24: Lashings.

Knots for Climbing, Caving and Rope Rescue

Coil: Climbers Coil (28); Chained Coil (29).

Loops: end loops: Algonquin Bowline (74); Double Fishermans Loop (112); Frost Knot (135B) for Etriers (135C); Figure Eight Loop (309); Figure Nine Loop (314); Climbers Bowline (409); double loops: Bowline on a Bight (437D); mid loops: Middlemans Knot (105); Alpine Butterfly Loop (123).

Bends: Double Fishermans Knot (109); Alpine Butterfly Bend (124); Tape Knot (132); Flemish Bend (313).

Rope to Waist Length: Anchor Hitch (310); Bowline on a Coil (442).

Harness: Diaper Harness (222); Chest Harness (223).

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see also Ladders, Heaving Line Weights, Chair Knots, First Aid and Surgery.

FANCY WORK

Button Knots

Stopper Knot (241); Cat Stopper Knot (242A); Rose Knot (243); Chinese Button Knot (475); Double Chinese Button Knot (476); English Button Knot (479).

Macramé Knots

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Sennits

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see also Chapter 21: Sennits.

Mats

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Turksheads

Four-Bight Three-Part Turkshead (464); Seven-Bight Three-Part Turkshead (464); Two-Bight Three-Part Turkshead (465); Five-Bight Three-Part Turkshead (466); Four-Bight Three-Part Turkshead (486C).

see also Chapter 20: Turksheads.

Lanyard Knots

Single-Strand: Chain of Overhands (60); Single Strand Riggers Knot (113); Conjoint Overhand Knot (121); Figure Eight Knot (279); Single-Strand Threefold Plait (282); Conjoint Figure Eight Knot (305); Sheepshank Loop (365); Single-Strand Round Sennit (510).

Two Strand: Japanese Lanyard Knot (114); Two-Strand Matthew Walker Knot (115); Matthew Walker Lanyard Knot (115C); Matthew Walker Horizontal Lanyard Knot (115E); Two-Strand Wall Knot (116D); Two-Strand Four-Part Matthew Walker Knot (117); True Lovers Knot (118); Flat Lanyard Knot (122); Two-Strand Diamond Knot (127B); Two-Strand Footrope Knot (127C); Reef Lanyard Knot (187); Surgeons Lanyard Knot (188); Lozenge Knot (307); Square Knot (322); Reciprocal Crossing Knot (324).

Covering

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Coxcombs: Chain Coxcomb (76B); Bannister Coxcomb (204); Solomon Coxcomb (205); Single-Strand Simple Coxcomb (377A); Single-Strand Zigzag Coxcomb (386A); Single-Strand Double Zigzag Coxcomb (387); Multistrand Simple Coxcomb (390); Dual-Strand Simple Coxcomb (391); Multistrand Zigzag Coxcomb (392); Multistrand Herringbone Coxcomb (393).

see also Chapter 20: Turksheads.

Other Decorative Knots

Bends and Binding Knots: Matthew Walker Bend (115D); Perpendicular Butterfly Knot (154); Parallel Butterfly Knot (158); Josephine Knot (482); Elongated Carrick Bend (488); Round Sennit Bend (511).

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Frogging: Shamrock Knot (119); Flower Knot (120); Frogging (493C).

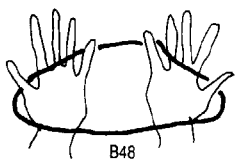
Hitches: Sennit Snug Hitch (302).

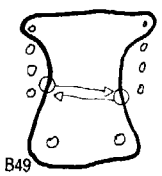
Loops: Twin Loops Knot (159); Sister Loops (445).

see also Chapter 12: Strand Knots.

CAT'S CRADLES

Just about all traditional societies all over the world use loops of string over the fingers to form pictures of all sorts of things in their environment, for fun, in competition or as magic. They were first seriously recorded in the 1880s, but they must be very ancient. I describe only one, which probably originated in New Caledonia but in the last century has spread all over Western Europe, where it is called the Cup and Saucer. You will need about 1.5 m of a flexible cord such as plaited nylon around 2–3 mm diameter. Form a continuous loop, either with a knot such as the Fishermans Knot (103) or by fusing the ends.


B48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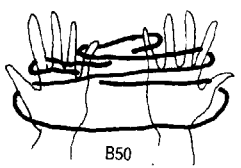
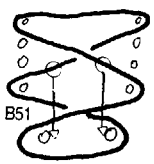
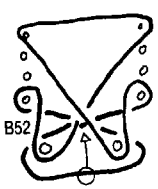
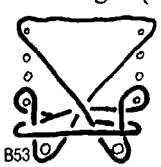
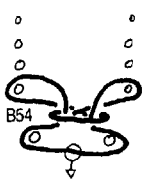

B50

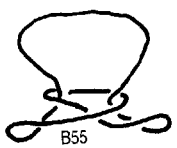

B51

Place the loop behind the thumbs, in front of the palms, and behind the little fingers (shown from the side in B48 and from the top in B49). Pick up from below the left palm string with the right index finger and the right palm string with the left index finger (B50, B51).

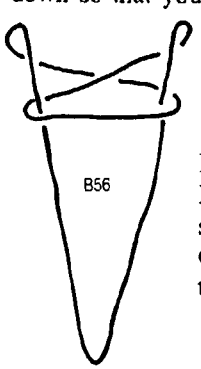

B52

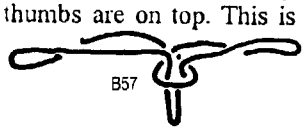

B53

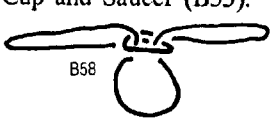

B54


B55

Pass your thumbs over the two nearest strings and under the third (B51), picking it up so that there are now two strings round the thumbs (B52). Slide the lower string over the thumbs and between the thumbs and index fingers (you may find it handy to use your teeth because you must not lose the upper string) (B53). Slip the loop off the little fingers (B54) and extend the hands down so that your thumbs are on top. This is the Cup and Saucer (B55).


B56


B57


B58

Pick up in the teeth the central thumb string (indicated in B54) release the thumbs and extend the arms, forming the Eiffel Tower (B56). Move the hands out sideways to give a straight line and a lead to the teeth (B57) and you have a Coat-hanger. Carefully release the teeth, and allow that loop to dangle down (B58) and you have a Sock on the Line.

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The International Guild of Knot Tyers

The International Guild of Knot Tyers was founded in 1982 by 25 keen knotters meeting in Scott's old ship, the *Discovery*, in London, to ". . . to promote the art, craft and science of knotting, its study and practice; to undertake research into all aspects of knotting; and to establish an authoritative body for consultative purposes."

The Guild grew, reaching over 700 members in 1991, 500 in Britain, 100 in North America, nearly as many in continental Europe (52 in The Netherlands), 19 in Australia and a dozen or more in another 6 countries. Members include farmers, miners, university professors, surgeons, sailors, accountants, magicians, police, riggers and a whole host of others, ranging in knotting skills from beginners to established consultants, authors and professional users of rope and knots.

Occasional meetings are held in localities where members are sufficiently numerous, and the Secretary presides over a lively correspondence, but otherwise the main means of keeping in touch is the quarterly newsletter, *Knotting Matters*. This contains articles, letters, queries, reviews, notes, Guild news and a little gossip. Recent numbers have included articles on a new method for a long splice, a mathematical proof of the law of the common denominator in Turksheads, knots for longlining, and spliced eye bowlines, and shorter notes on a whole variety of novel knots, braids, splices, mesh knots, puzzles and so on, and on errors in Ashley's *Book of Knots* and queries about knots for kites, and the identity of a Crinnan Knot. Back issues contain at least as wide a variety, for beginners and the experienced alike.

From time to time, exhibitions are displayed in centres of high Guild membership: they have even included every knot in Ashley!

The Guild also publishes manuals, wall charts and postcards, and sells its own ties and badges.

The present Secretary is Nigel Harding, 3 Walnut Tree Close, Stonham Aspal, Stowmarket, IP14 6DF, England.